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United States
Department of
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Forest
Service

Southwestern
Region

R3-95-1

Surveys To Measure Tree Damage Caused By A Western Spruce Budworm Outbreak On The Carson National Forest, 1984 and 1991

#1244

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Cover Photo — Author William Klein examining a western spruce budworm damage plot in Red River Canyon, Carson National Forest, New Mexico, 1991.

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Published June 1995 on recycled paper.

Abstract

In 1984 a survey using double sampling techniques was conducted in a portion of the Carson National Forest, New Mexico, to measure the damage to mixed conifer stands caused by a persistent outbreak of the western spruce budworm. The method used was a stratified random sampling design using color infrared aerial photography followed by ground truth. In 1991, using the 1984 aerial photographs to located the primary sampling units, the ground portion of the survey was repeated with slight modification.

A statistical analysis of survey accuracy showed good agreement with photo interpretation (stratification) and ground sampling, and that stratification into 4 damage classes improved survey efficiency, particularly with the larger trees in the more heavily damaged areas.

Forest composition was primarily Douglas-fir, followed by Engelman spruce, white fir and corkbark fir. Non-host species made up 13 percent of the stands.

Douglas-fir suffered the heaviest mortality and permanent crown damage. In the two heaviest damage strata, white fir was the second most abundant host species, while in the two least damaged strata, Engelmann spruce was the second most abundant host species. The smaller diameter classes of all host species experienced the most damage. There was no consistent relationship between stand density and damage, but the two extreme basal area densities of 115.3 $ft.^2$ and 158.3 $ft.^2$ occurred in the no-damage and dead strata, respectively. The relative abundance of Douglas-fir increased with increased damage.

Reproduction was considered ample, but varied considerably between damage strata.

It was recommended that, where practical, future damaging outbreaks of the western spruce budworm could be minimized by reducing the basal area, removing the shade tolerant host trees (primarily the larger white firs) and favoring the nonhost species, particularly ponderosa pine.

It was also suggested that the survey be repeated at 4 to 5 year intervals to monitor the stands recuperative abilities, to record changes in succession and to evaluate future budworm outbreaks and impacts.

Acknowledgments

The authors thank Michael Marsden and Chet Jensen, both retired USDA Forest Service statisticians for their assistance with and review of the statistical analyses of these surveys; and John Mathis, USDA Forest Service mensurationist, Intermountain Region, for his valuable assistance in managing and analyzing the data collected during these surveys.

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Introduction

The western spruce budworm, *Choristoneura occidentalis Freeman*, is the most widespread and destructive defoliator of coniferous forests in the western United States and Canada. In portions of New Mexico, periodic outbreaks of varying duration, estimated by tree-ring reconstruction methods, have been shown to have occurred as early as 1700 (Swetnam and Lynch, 1989). These studies also showed an increasing frequency of outbreaks during the past 50 years; more so than during any previous period.

Background

The outbreak in which these damage surveys were conducted is in Red River Canyon—a scenic and high impact recreation area—on the Questa Ranger District, Carson National Forest. Significant defoliation, first reported in 1976, increased in both intensity and extent with peak defoliation recorded in 1984. In 1985 and 1986, portions of the infestation were aerially sprayed with a commercial formulation of Bacillus thuringiensis. By 1986, the infestation declined, primarily due to reduced food supply, and has remained undetectable to date.

Concern over the highly visible defoliation and anticipated permanent forest damage in Red River Canyon, prompted a comprehensive damage survey in 1984. A follow-up damage survey was conducted in the same area in 1991.

Survey Goals

The major goals of these surveys were to:

1. Provide the forest manager with statistically meaningful estimates of both type and amount of damage to host tree species.

2. Produce a comprehensive map showing the distribution and intensity of budworm caused damage in 1984 within the survey area.

3. Provide the forest entomologist with the above information as a guide for the conduct of future biological evaluation and damage surveys.

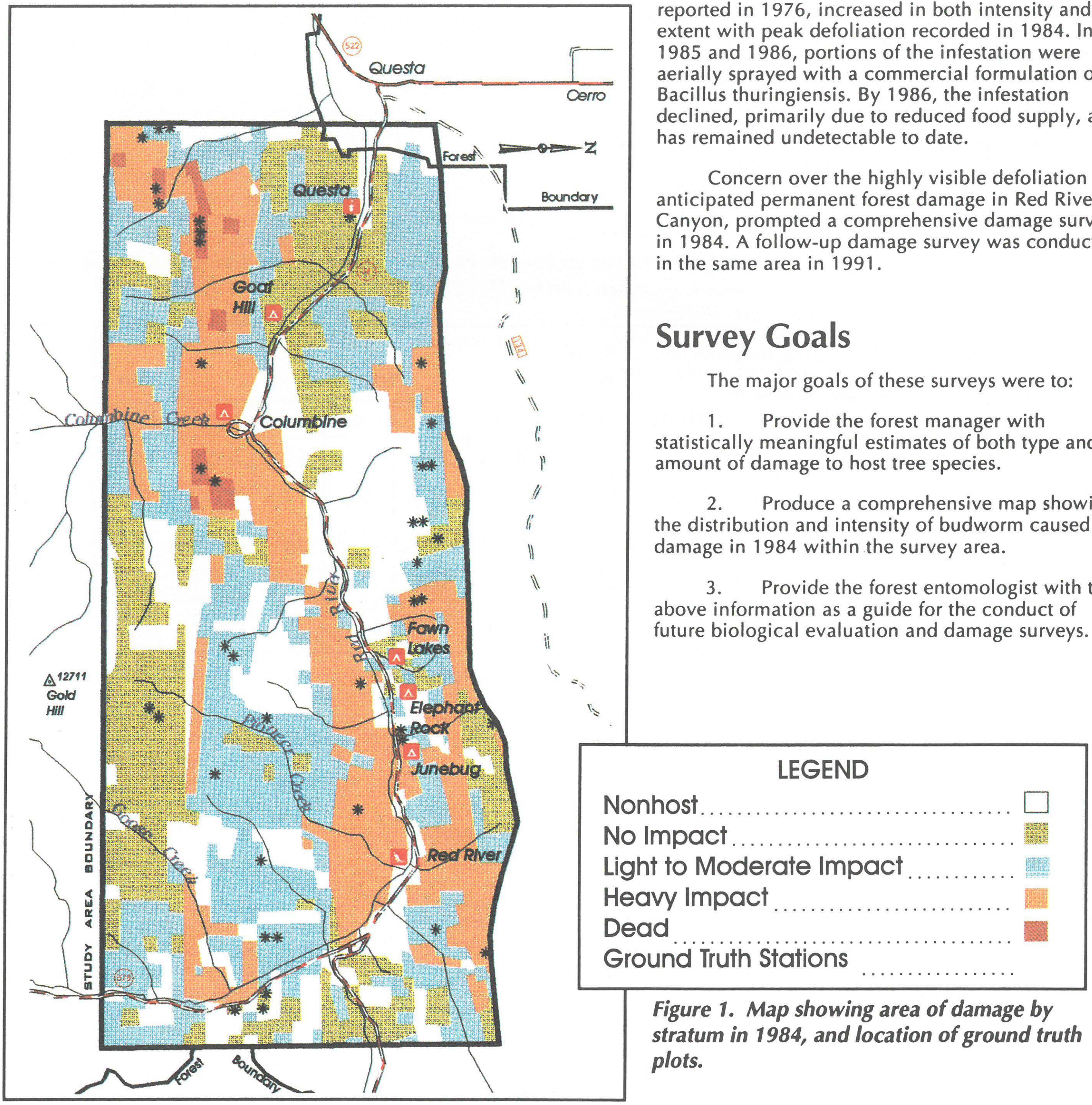
522
Questa
Cerro
Forest Boundary
N
Questa
Goat Hill
Columbine Creek
Columbine
Fawn Lakes
Red River
Elephant Rock
Junebug
Pioneer Creek
Red River
12711 Gold Hill
STUDY AREA BOUNDARY
Forest Boundary
LEGEND
Nonhost
No Impact
Light to Moderate Impact
Heavy Impact
Dead
Ground Truth Stations

Figure 1. Map showing area of damage by stratum in 1984, and location of ground truth plots.

4. Test the efficacy of a 2-stage stratified random sampling design in estimating budworm caused damage.

5. Establish a system of permanent plots to monitor long-term effects of budworm on the forest environment.

Survey Area

The survey area, approximately 35,000 acres (13,000 hectares) encompasses Red River Canyon east from Questa to Red River Pass (Figure 1).

The dominant host tree species is Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco.), followed with varying proportions of white fir (*Abies concolor* (Gord. and Glen.)), Engelmann spruce (*Picea engelmannii Parry*), and Corkbark fir (*Abies lasiocarpa* var. *arizonica* (Merriam) Lemm.)

Non-host species accounted for 13 percent of the forested area (Table 1a.)

Methods

The initial survey, using color infrared photography, was conceived, planned, conducted and reported on during a 4-month period (August-November, 1984). The 1991 ground survey, using the 1984 aerial photos as a base, generally followed the 1984 ground survey procedures.

Table 1a. Average Percent Basal Area Per Stratum, Living and Dead (Greater than 5 inches DBH), by Host and Non-Host Species, 1991

	Basal Area	Host Species					Non	
Strata	Sq. Ft.	DF	ES	WF	CBF	Total	Host	Total
1	115.3	43.0	25.7	6.3	10.8	85.8	14.2	100
2	151.8	45.1	25.9	5.8	14.6	91.4	8.6	100
3	110.2	55.9	1.6	23.4	0.2	81.1	18.9	100
4	158.3	61.0	0.6	25.1	0.2	86.8	13.2	100
Average[1]	127.9	47.8	18.7	11.1	9.4	87.0	13.0	100

[1] Weighted proportionally by strata.

The 1984 and 1991 Surveys

The 1984 Survey

The survey utilized a 2-stage stratified sampling design, the first stage using large scale color infrared aerial photography and the second stage (ground truth) variable plot cluster sampling.

Color infrared transparencies at a mean scale of 1:5000 were obtained by a private contractor on September 6 between 9:30 a.m. and 3:30 p.m., MST. The processed film was received on September 18 and immediately indexed and located on 7 1/2-minute quadrangle sheets.

The first phase of photo interpretation involved subdividing the 9 x 9-inch photos into 25 (5 x 5) primary sampling units (PSU's) or cells, each cell representing approximately 13 acres (5 hectares). All 25 PSU's on every other photograph (60 percent overlap) along each flight line were monoscopically interpreted and classified as either host (containing more that 50 percent host trees) or non host; if host, then classified into one of four strata:

1. **No defoliation.** No apparent defoliation.

2. **Light-medium defoliation.** Tree crowns more than 50 percent defoliated; widely scattered tree mortality (any cause).

3. **Heavy defoliation.** Tree crowns more than 50 percent defoliated; widely scattered tree mortality (any cause).

4. **Dead.** More than 50 percent of the trees dead (any cause).

Prior to photo interpretation, several "images" were marked on the photos and viewed stereoscopically in the field to enable the interpreters to associate an actual condition with its image. Many times, colors resulting from bulk processing can be somewhat unreliable.

More than 1,700 PSU's were stratified by damage class; of these a total of 47 were selected for ground truth. Those plots more readily accessible were then chosen disproportionate to their occurrence so as to obtain better representation of the heavy and dead categories. However, due to personnel and time constraints, only 41 plots were sampled.

The center of each 13-acre PSU selected for ground truth was located in the field and served as the center point for a set of 5 variable plot (BAF 10) and 1/300-acre reproduction plot clusters. Both plots had common centers established in cardinal directions at three chain intervals from the plot center.

Within each variable plot, all trees living and dead greater than 5 inches DBH were measured and classified into one of the four damage categories: (1) no defoliation; (2) moderate defoliation (less than 50 percent of the crown defoliated); (3) heavy defoliation (50 percent or more of the crown defoliated); or, (4) mortality caused, at least in part, by repeated defoliation. Tree height was measured on the first 25 percent of the live trees in each plot. No attempt was made to estimate top-kill since it is prone to error.

Within each 1/300-acre reproduction plot, all trees, living and dead, taller than 3 inches but less than 5 inches DBH were recorded and damage estimated according to the above criteria.

Neither plot centers nor trees were permanently marked for future reference.

A statistical program, R03 INDIDS (Bennett, et. al., 1983), was used to compute and present the output for each damage strata. The tree data was compiled into 2 general size categories: less than 5 inches DBH and greater than 5 inches DBH.

A map showing the distribution and intensity of budworm damage as estimated from the aerial photographs was also prepared (Figure 1).

An important part of any aerial photographic study using double sampling, is to determine the accuracy of photo estimates with actual ground data (ground truth). So as to make the variable plot ground data amenable to the photo estimates, a damage index (I) was calculated for each variable plot cluster (j), as follows:

$$I(j) = 1 + [(1 - N) * ((1 * L - M) + (2 * H) + (3 * D))]$$

where:

N[1]= No defoliation
L - M[2]= Light to moderate defoliation (<50%)
H[2]= Heavy defoliation (>50%)
D[2]= Dead

Number Of Primary Sampling Units

Damage Category	Area* (Acres)	Photo Interpretation	Ground Truth Selected	Ground Truth Sampled
Non Host	7,100	362	0	0
No Damage	8,100	413	13	11
Light-Moderate	10,500	536	13	11
Heavy	9,000	455	14	12
Dead	300	15	7	7
Total	**35,000**	**1,781**	**47**	**41**

*Determined by planimetric methods.

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[1] *Percent of total cruise.*
[2] *Percent of total damage.*

This formula assigns a numerical damage rating to each variable plot cluster (based on basal area) and assumes that a given number of heavily damaged or dead trees carries proportionally more weight than the same number of lightly damaged trees. For example, a plot containing (only) 30 percent dead would be rated 1.90, while a plot with (only) 30 percent light-moderate defoliation would receive a rating of 1.30. A plot showing no damage would be rated 1; similarly, a completely dead plot would be 4. The individual plot damage indexes were regressed against their respective photo stratification estimates.

Overall survey efficiency was determined by comparing the population variance of a simple random sample and the variance within each of the four strata, as suggested by Cochran (1977). It is assumed that the population within each strata is more homogeneous than between them.

The 1991 Survey

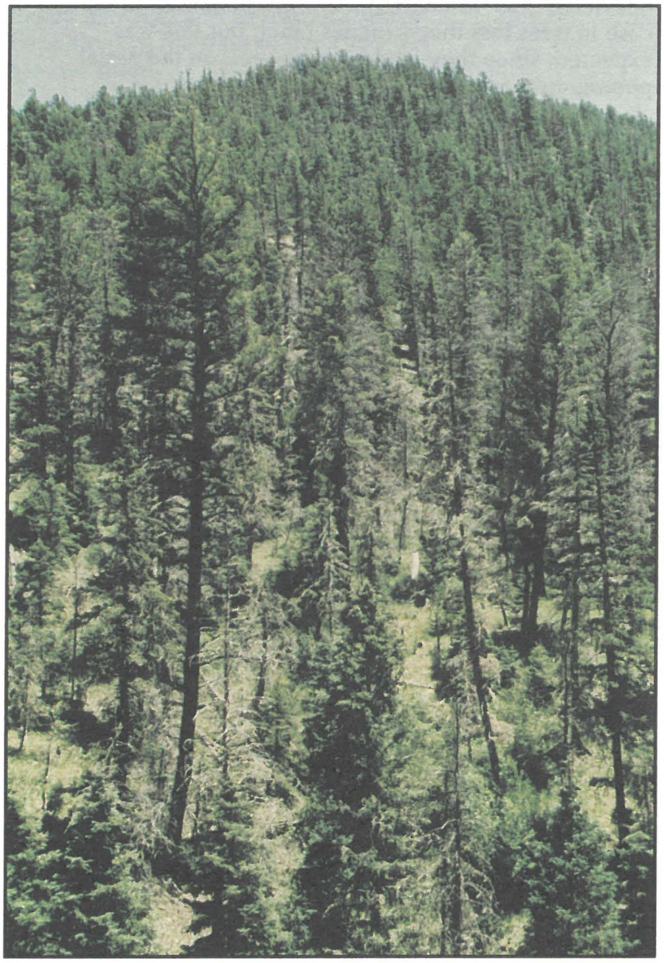
The 1991 follow-up survey followed the 1984 ground survey with a few modifications. The same (1984) aerial photographs were again used to locate the 41 PSUs. Both variable and fixed plots were established in identical manner, except, this time, the plot centers were permanently marked with plastic stakes. In the variable plots, all "IN" trees (greater than 5 inches DBH) were marked with numbered, metal tags at DBH. On each plot, the first 3 live trees of each species were measured for height.

In the 1984 ground survey, most all budworm-caused damage was recent defoliation. In 1991, the budworm population and current defoliation was practically nonexistent. Crown damage had resulted from several years of repeated feeding, manifested by dead twigs, whole branches, portions of crowns or entire trees. Accordingly, the on-the-ground damage estimates were changed slightly, as follows:

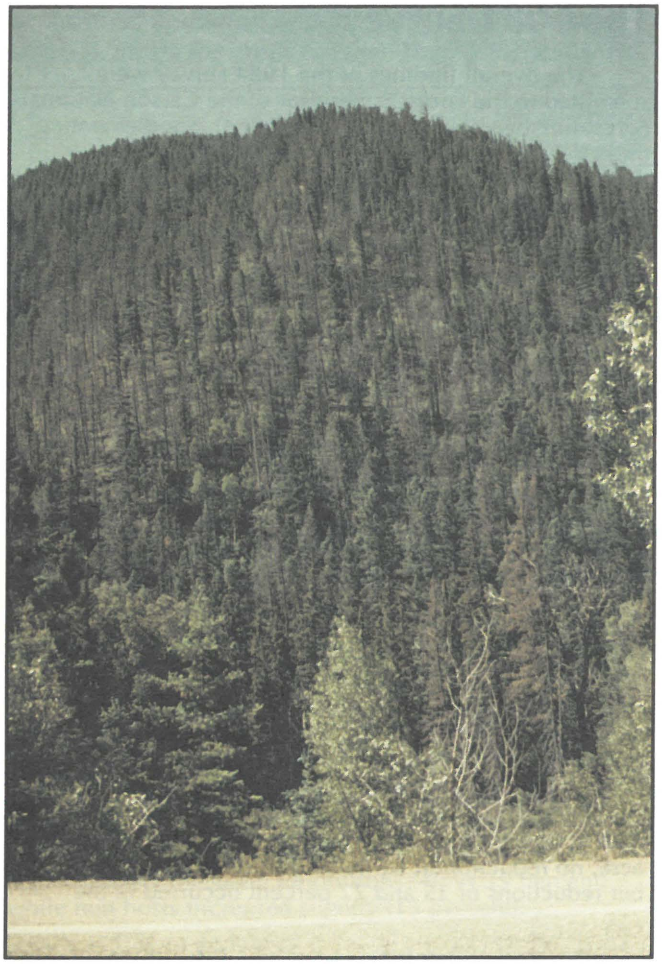
1. No apparent damage.
2. Less than 1/3 of the crown damaged.
3. Between 1/3 and 2/3 of the crown damaged.
4. Greater than 2/3 of the crown damaged.
5. Tree dead.

When feasible, records were also made on other forms of damage, including past (recent) and present bark beetle activity.

The data was compiled and computed using a Lotus 123 spread sheet program. Cubic foot volume was computed for each tree species using the formulas developed by Hann and Bare, 1978. The tree data was compiled into trees less than 5 inches DBH(reproduction and poles) and by 1 inch diameter class of those trees greater than 5 inches DBH.

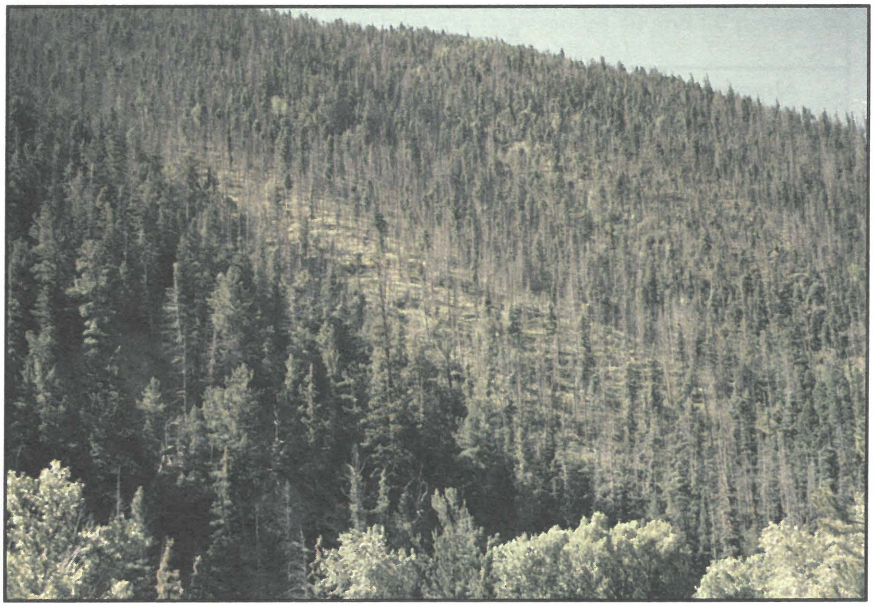


Scattered individual tree mortality.



Pockets of concentrated tree mortality.

Figure 2. These 3 photos depict the range of damage associated with the western spruce budworm outbreak in Red River Canyon, New Mexico, 1991.



Widespread mortality across a large area.

Results

The 1984 Survey

The overall findings of the 1984 survey were submitted to the Forest Supervisor of the Carson National Forest in November 1984 (Parker 1984). Supplementing these data was the map showing the distribution of damage throughout the survey area (Figure 1). Figure 2 photographically depicts the range of cumulative damages associated with the budworm outbreak in Red River Canyon by 1991.

Aerial Photo Interpretation

Relatively good agreement was found between photo interpretation (stratification) and ground truth when the variable plot data was converted to a single plot damage index and compared by linear regression. A tabulation of the aerial photo estimates with their respective ground truth damage indexes is shown in Table 2. An r^2 (Coefficient of determination) value showed that 74 percent of the photo damage estimates were associated with ground truth.

Stratification

Independent of photo interpretation accuracy, stratification into 4 damage classes improved survey efficiency. With trees larger than 5 inches DBH and expressed as basal area, the overall variance of all strata was reduced by an average of 16 percent (Table 3). The variances of the heavy and dead strata were reduced by 23 and 26 percent, respectively. When expanded to trees per acre, no reduction in variance occurred in the light strata but reductions of 35 and 22 percent occurred in the heavier strata. No improvement was recorded in either case in trees less that 5 inches DBH, but this was expected, since they could not be seen on the aerial photographs.

Second stage sampling (variable and fixed plots)

A generalized summary of the ground cruise compared to 1991 variable and fixed plot data is shown in Tables 4a through 5e. Direct comparisons of the two surveys should be made with some reservation since they were conducted 7 years apart (in growth, mortality, etc.), the same trees were not remeasured and budworm activity and damage continued after 1984. However, some differences in the two data sets may be worthy of mention, which may reflect true conditions. There were significant increases in budworm caused mortality in the three damage strata and in the number of non host seedlings (reproduction) in all strata. Additionally, between the two sample periods, there was an increase in basal area of live, host species (5 inches DBH and greater) in the no damage and light-medium strata but a decrease in the heavy and dead strata. In spite of the host mortality, there was an overall increase in basal area of both host and non host during this sampling interval (Tables 4e and 5e).

The 1991 Survey

The results of the 1991 ground survey by strata are shown in Tables 7a through 9e and Figures 7a through 9j. Figures 3 through 6 are photographic examples of ground plots representing the no damage, light-medium damage,

Table 2. Comparison of Aerial Photo Damage Stratification Ratings With Variable Plot (Ground Truth) Damage Index Ratings, 1984.

	Aerial Photo Damage Strata Ratings							
Number	None (1)		Light-Med. (2)		Heavy (3)		Dead (4)	
Sampled	Plot	Index*	Plot	Index*	Plot	Index*	Plot	Index*
1	5-33-14	1.00	7-6-9	1.07	3-27-18	1.28	9B-13-22	2.33
2	11-40-7	1.00	9A-21-11	1.39	5-15-10	1.95	9B-2-11	2.60
3	11-14-8	1.00	11-40-8	1.46	3-21-8	2.10	11-37-6	2.73
4	11-14-2	1.06	9A-15-11	1.54	3-31-8	2.14	9B-13-17	2.90
5	7-3-8	1.06	3-29-7	1.56	3-40-14	2.22	11-40-20	2.92
6	9A-2-1	1.10	3-37-8	1.78	9B-7-10	2.52	9B-13-12	2.95
7	3-34-1	1.12	7-6-20	1.79	5-11-12	2.61	9B-2-12	3.43
8	3-29-4	1.13	7-12-13	1.90	1A-8-17	2.75		
9	7-3-12	1.18	3-18-3	2.13	3-27-15	2.83		
10	9A-21-1	1.18	7-17-8	2.29	3-31-22	2.94		
11	3-34-10	1.29	1B-10-3	2.37	11-37-7	3.14		
12					3-21-22	3.17		

** Ground truth damage index rating.*

heavy damage, and dead strata stand conditions at the time of the 1991 ground survey.

In the discussions which follow, stand characteristics will be discussed in terms of basal area-unless otherwise noted-since basal area is the best indice of stand density.

The damage strata assignments made in 1984 from the aerial photos remained applicable in 1991, in terms of tree mortality and light-moderate to heavy crown damage (Tables 7a through 9e).

Table 3. Comparison of Stratified Random Sampling With Simple Random Sampling by Damage Strata for Trees Greater Than 5 Inches DBH.

Category	Damage Class (Stratum)	Mean	Variance		VS/VR	Difference In Percent	
			Strat.	Rand.		+	—
Trees Per Acre	1	112.71	402.99	400.92	1.01		1
	2	41.62	78.46	75.04	1.05		5
	3	40.66	50.72	78.25	0.65	35	
	4	2.72	4.71	6.06	0.78	22	
Basal Area	1	50.86	45.76	51.28	0.89	11	
	2	27.52	23.34	24.19	0.96	04	
	3	20.86	16.65	21.53	0.77	23	
	4	0.75	0.34	0.46	0.74	26	

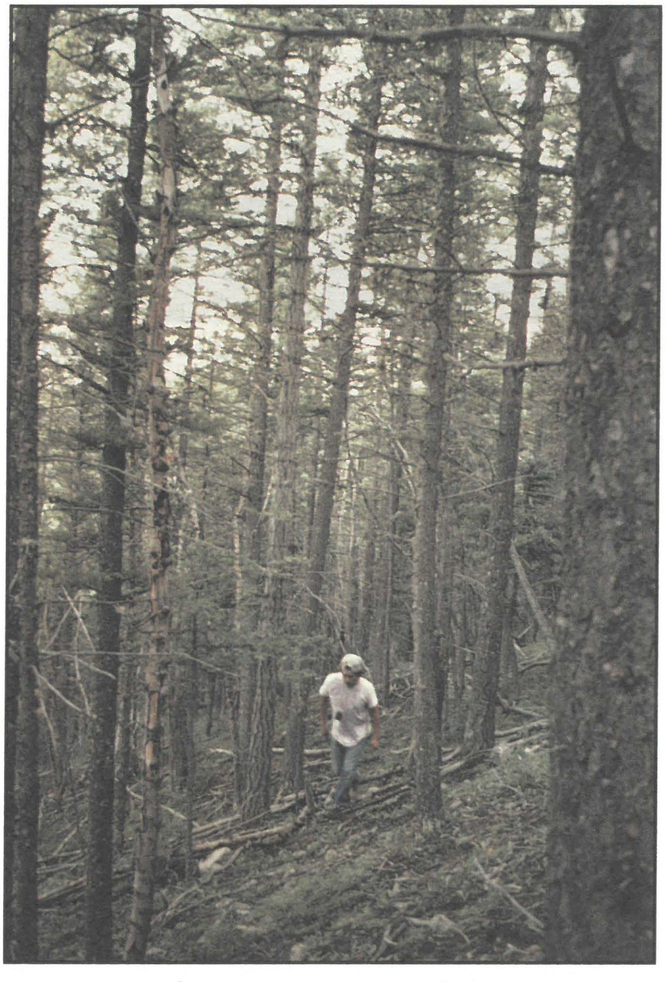


Figure 3. No damage stratum ground plot, 1991.

Prior to this outbreak, Douglas-fir was the dominant host species (48 percent) followed by Engelmann spruce (19 percent), white fir (11 percent) and corkbark fir (9 percent). Non hosts accounted for 13 percent of the forested area (Table 1). In the heavy damage and dead strata, however, Engelmann spruce was an insignificant component, 1.6 and 0.6 percent respectively while white fir occupied second position, 23.4 and 25.1 percent, respectively.

In 1991, following the period of mortality (all causes), Douglas-fir declined slightly but still remained the dominant species (45 percent), other hosts maintained approximately the same proportions (40 vs 39 percent) while non hosts increased slightly (15 percent).

Mortality attributed to repeated defoliation represented less than 4 percent of the total basal area in the no damage and light-moderate damage strata. However, in the heavy damage and dead strata, mortality attributed to defoliation represented 40 and 56 percent of the basal area, respectively (Table 1b).

There was no consistent relationship between stand densities and damage intensity strata; however, there was a relatively large difference between the no damage stratum (115.3 $ft.^2$) and the dead stratum (158.3 $ft.^2$).

There are significant differences in species composition and relative abundance between the various strata (Table 1a). In the two heavily damaged strata (heavy and dead), Douglas-fir (56 and 61 percent, respectively) and white fir (23 and 25 percent, respectively), comprised more than 79 percent of the stands, while the other two hosts, Engelmann spruce (2 and 1 percent, respectively) and corkbark fir (1 and 1 percent, respectively) were practically nonexistent. In the two lightly damaged strata (no damage and light-medium), Engelmann spruce (26 and 26 percent, respectively) and corkbark fir (11 and 15 percent, respectively) were considerable more dominant while white fir (6 and 6 percent, respectively) was the minor component.

The relative abundance of Douglas-fir increased with each damage strata (Table 1a).

In terms of trees per acre, the smaller diameter classes (understory) of Douglas-fir and other host trees suffered and greatest mortality due to budworm defoliation. The same trend held true for crown damage (Tables 8a through 8e and 9a through 9j).

Live reproduction density was more than sufficient (2,650 trees/acre) throughout the survey area but it was variable between strata (Table 6). Of the host trees, Douglas-fir was more evenly represented in each damage strata than any other species. Overall, corkbark fir was the dominant reproduction species, but it occurred in only the two lightest strata, which was not surprising since a seed source was practically non existent in the heavier strata. As with the smaller diameter trees, Douglas-fir had the highest mortality from budworm feeding; the degree of mortality consistently increased with each damage strata. In the dead strata, for example, 65 percent of Douglas-fir reproduction had been killed, while no mortality was recorded in the no-damage strata. Overall, host reproduction was more prevalent (57 percent) than non host reproduction (43 percent).

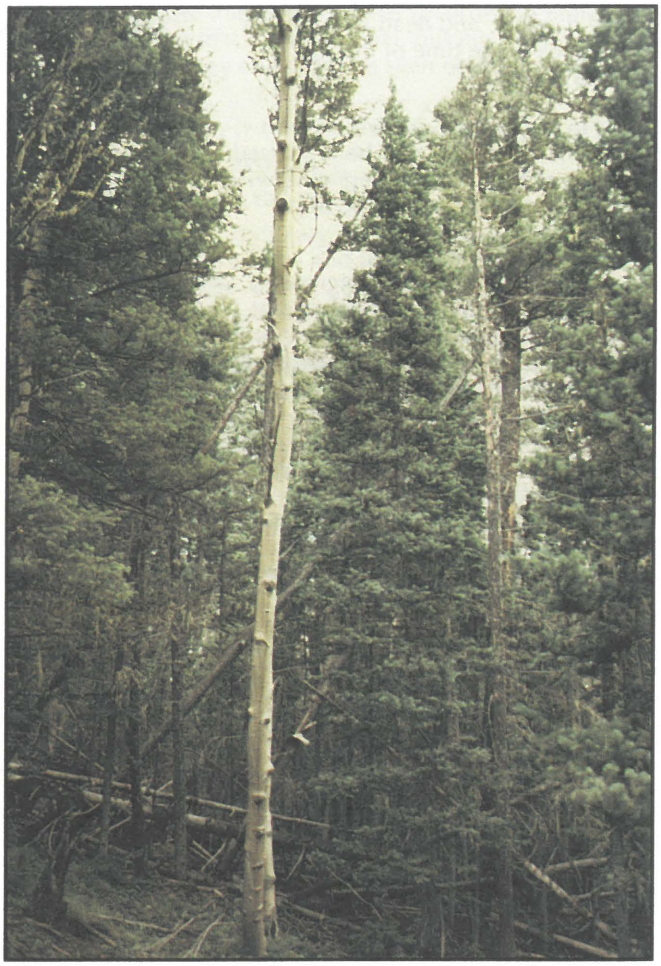


Figure 4. Light-medium damage stratum ground plot, 1991.

Table 1b. ***Average Percent Basal Area of Host Tree Species, Living and Dead (Greater Than 5 Inches DBH), and Mortality by Defoliation and Other Causes, 1991.***

Strata	Basal Area Sq. Ft.	Douglas-fir L[1]	Douglas-fir DD[1]	Douglas-fir DO[1]	Other Hosts L	Other Hosts DD	Other Hosts DO	Total L	Total DD	Total DO	Total
1	98.9	48.2	0.7	1.3	45.6	0.5	3.6	93.7	1.3	5.0	100
2	138.7	46.0	2.5	0.7	46.3	1.1	3.4	92.3	3.5	4.2	100
3	89.5	35.5	31.4	2.0	21.8	8.7	0.6	57.3	40.0	2.6	100
4	137.4	30.6	38.6	1.0	12.7	17.0	0.0	43.2	55.8	1.0	100
Average [2]	111.3	43.7	10.0	1.3	39.3	3.1	2.7	83.0	13.1	4.0	100

[1] L = Live; DD = Dead From Defoliation; DO = Dead From Other Causes

[2] Weighted Proportionally By Strata.

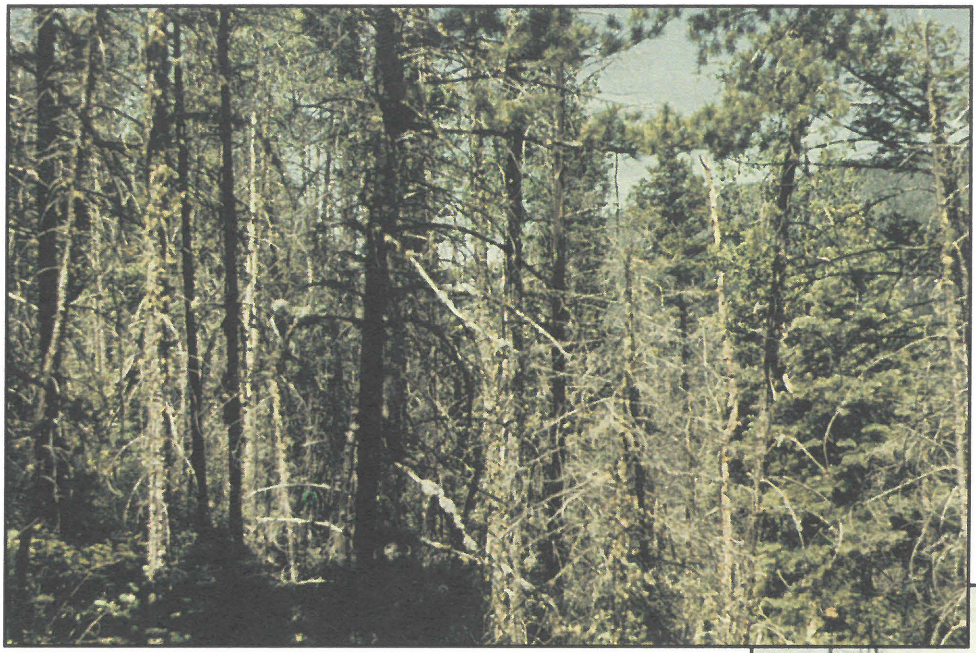


Figure 5. Heavy damage stratum ground plot, 1991.

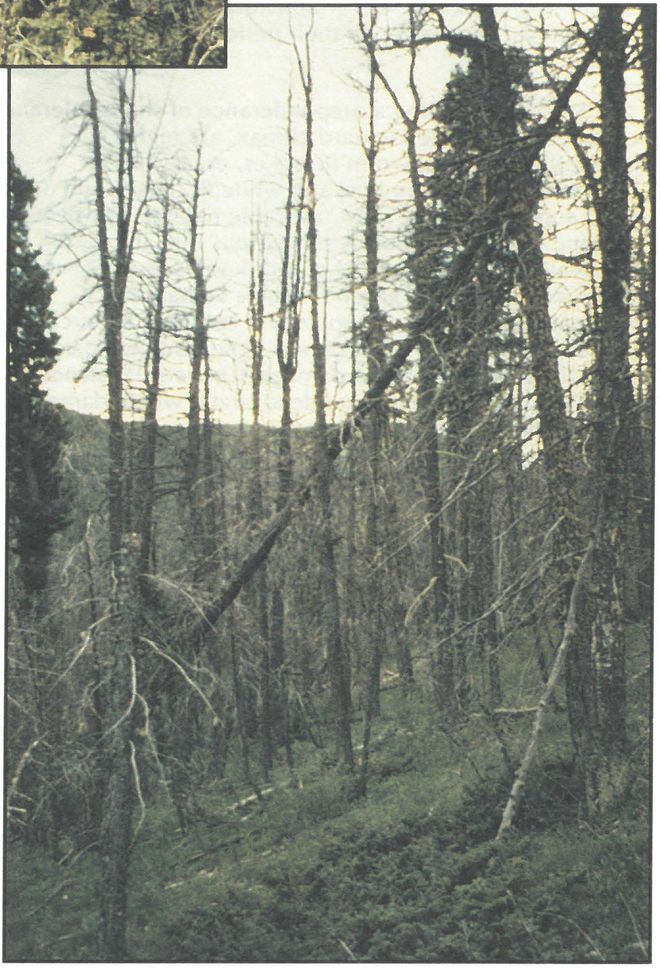


Figure 6. Dead stratum ground plot, 1991.

Discussion And Recommendations

It bears repeating that the crown damage recorded in the 1991 ground survey was permanent damage, since budworm populations had already declined. For example, a classification of 4 meant that 2/3 of the crown was dead, which usually signified the upper crown including the top. If and when these trees ever recover—in some cases doubtful—they will be permanently deformed and most likely a source for infection (disease).

In an ongoing budworm outbreak, the host understory typically suffers the most damage since the larvae are continually migrating downward due to hunger or physical disturbances. When exiting their feeding niches, they spin downward on silk-like threads until they land on suitable foliage or reach the ground. If they do not land on suitable substrate they will starve or become prey.

Historically, the major factors known to sustain budworm outbreaks and damage are associated with species composition and tree vigor. Generally, tree vigor may decline with advanced stand age and increased density. Environmental factors such as weather (drought) and fire tend to exacerbate or ameliorate these relationships, depending on their periodicity, severity, and duration.

Stands containing a preponderance of shade tolerant host trees that succeed toward climax, are highly susceptible to the budworm (Brookes, et. al. 1985). Douglas-fir is a primary host and white fir (heavy and dead strata) appear to be the most favorable habitat. The denser the stand (dead strata), the less vigorous it is, the more food available to the budworm and there is less chance of larvae dropping to the ground. Stands containing significant proportions of spruce and corkbark fir, such as those found in the no damage and light-moderate damage strata, sustained little to no damage. Conversely, stands within the heavy damage and dead strata, where damages were prevalent, contained little or no spruce or corkbark fir. The cooler and moister conditions associated with spruce and corkbark fir stands appear not to favor budworm survival and development.

The condition and species makeup of these stands in the survey area has resulted largely from past fire control and timber harvesting (economic selection) efforts, which has discriminated against both seral host and non host (ponderosa pine) species; thereby favoring the shade tolerant species.

Douglas-fir beetle activity was recorded throughout the survey area, but it was not judged to be a significant cause of tree mortality or serious threat to the residual stands. Most of the Douglas-firs attacked by the beetle were under severe stress from sustained budworm defoliation and would most likely have died without the beetle. Observations made of the attacked boles showed very little, if any, beetle emergence, suggesting that the already deteriorating phloem was not suitable for beetle survival.

Management options to reduce future budworm activity and damage in management units where recreation is the primary use are limited. Control by aerial spraying of an insecticide is one option and even if relatively successful (killing larvae), it has only short term effects and does not change the conditions which are responsible for the outbreak in the first place. In the absence of fire and/or some level of timber harvesting, the stands will continue to stagnate and perpetuate shade tolerant host trees which will only assure future outbreaks.

In those areas where tree harvest is feasible, efforts should be directed to reducing stand susceptibility by reducing height class structure, reducing the percentage of climax host species, particularly on white fir habitat types, reducing the basal area of the residual stands (particularly Douglas-fir) to minimize competition and increase growth (vigor) and to reestablish non host species suited to the site, i.e., ponderosa pine. Some basal area reduction can be accomplished by removing the most heavily damaged trees which could survive indefinitely but never fully recover. Removal (salvage) of the dead trees will reduce the fire hazard in those areas (heavy strata) where they are concentrated.

Some comment should be made regarding the timing and quality of the aerial photography, which formed the base for the survey. The photography was taken on September 6, 1984, long after the cessation of budworm feeding and recognizable foliage damage. The ideal time would have been during early July, when pupation had peaked and damage was most visible. During this 8-week interval, many of the damaged needles had fallen, resulting in more subtle color signatures.

The late photography (low sun angle) also compromised photo image identification by increasing shadow length, particularly along the southern-most flight lines (generally north-facing slopes), where most budworm feeding and damage occurred. In addition, a antivignetting filter was not used, leaving the corner areas of the photos practically uninterpretable. These problems can be minimized in future surveys by better synchronization of the imagery with peak defoliation damage (late June, early July), and using a antivignetting filter or longer camera lens.

It is also recommended that the survey be repeated at 4 to 5 year intervals to monitor the stands recuperative abilities, to record any subtle but significant changes in succession and to evaluate future western spruce budworm outbreaks and resultant impacts.

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Appendix

Table 4a. ***No Damage Stratum—Summary of Live and Dead Stand Components (All Species) as Recorded During the 1984 and 1991 Ground Surveys.***

		Host Tree Species										Combined Non Hosts		Total	
		DF		WF		ES		CBF		Total					
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5"	1984	174.5	5.2	120.0	0.6	332.7	1.9	780.0	7.1	1407.3	14.7	469.1	7.9	1876.4	22.7
	1991	218.2	4.9	174.5	0.9	398.2	2.4	1636.4	2.1	2427.3	10.2	1690.9	6.4	4118.2	16.6
>5"	1984	82.2	43.2	5.1	2.4	44.8	20.7	31.8	10.9	163.9	77.2	43.8	15.6	207.7	92.8
	1991	79.8	49.6	15.2	7.3	55.2	29.6	32.6	12.4	182.8	98.9	39.6	16.4	222.4	115.3

Table 4b. ***Light-Medium Damage Stratum—Summary of Live and Dead Stand Components (All Species) as Recorded During the 1984 and 1991 Ground Surveys.***

		Host Tree Species										Combined Non Hosts		Total	
		DF		WF		ES		CBF		Total					
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5"	1984	196.4	1.5	237.1	0.9	605.5	2.4	889.1	6.8	1925.5	11.6	212.7	1.2	2138.2	12.8
0	1991	425.5	5.7	180.0	1.9	420.0	2.1	790.9	6.9	1816.4	16.6	1090.9	3.4	2907.3	20.0
>5"	1984	76.7	55.1	9.1	6.9	59.7	28.0	61.2	19.6	206.7	109.6	33.1	12.2	239.8	121.8
0	1991	105.6	68.4	18.0	8.9	77.4	39.3	64.3	22.2	265.3	138.7	33.3	13.1	298.6	151.8

Table 4c. ***Heave Damage Stratum—Summary of Live and Dead Stand Components (All Species) as Recorded During the 1984 and 1991 Ground Surveys.***

		Host Tree Species										Combined Non Hosts		Total	
		DF		WF		ES		CBF		Total					
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5"	1984	180.0	5.1	165.0	2.2	5.0	0.0	0.0	0.0	350.0	7.3	95.0	0.5	445.0	7.8
	1991	285.0	7.3	435.0	6.5	40.0	0.0	0.0	0.0	760.0	13.9	615.0	2.0	1375.0	15.8
>5"	1984	93.7	54.5	41.9	21.7	0.8	0.5	0.6	0.2	137.1	76.8	18.6	14.0	155.7	90.8
	1991	96.6	61.7	58.5	25.8	4.9	1.8	0.1	0.2	160.1	89.5	37.4	20.7	197.5	110.2

Table 4d. ***Dead Stratum—Summary of Live and Dead Stand Components (All Species) as Recorded During the 1984 and 1991 Ground Surveys.***

		Host Tree Species										Combined Non Hosts		Total	
		DF		WF		ES		CBF		Total					
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5"	1984	454.3	8.5	4080.0	9.3	0.0	0.0	0.0	0.0	4534.3	17.8	385.7	3.2	4920.0	21.0
	1991	677.1	14.6	480.0	6.4	8.6	0.0	0.0	0.0	1165.7	21.0	1457.1	7.0	2622.9	28.0
>5"	1984	151.6	72.6	81.0	33.7	0.0	0.0	1.3	0.3	233.9	106.6	37.5	11.4	271.4	118.0
	1991	210.2	96.6	87.8	39.7	2.5	0.9	1.9	0.3	302.3	137.4	49.7	20.9	352.1	158.3

Table 4e. ***All Strata (Weighted by Area)—Summary of Live and Dead Stand Components (All Species) as Recorded During the 1984 and 1991 Ground Surveys.***

		Host Tree Species										Combined Non Host		Total	
		DF		WF		ES		CBF		TOTAL					
DIA.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5"	1984	187.4	3.8	218.5	1.3	328.2	1.5	564.1	4.6	1297.2	11.2	251.1	2.9	1548.3	14.2
	1991	322.7	6.1	263.9	3.1	286.7	1.5	772.7	3.2	1646.0	13.9	1115.5	3.8	2761.5	17.8
>5"	1984	84.5	51.6	19.2	10.6	35.9	16.8	32.7	10.7	173.3	89.7	31.6	13.8	204.9	103.4
	1991	96.3	61.1	31.0	14.2	46.7	24.0	33.7	12.0	207.8	111.3	36.6	16.6	244.4	127.9

Table 5a. No Damage Stratum—Summary of Tree Condition of Douglas-fir and Other Hosts as Recorded During the 1984 and 1991 Ground Surveys.

		Douglas-Fir						Combined Other Hosts						Combined Other Hosts							
		Live		Dead Defol		Dead Other		Live		Dead Defol		Dead Other		Live		Dead Defol		Dead Other		All Conditions	
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5”	1984	174.6	5.2	0.0	0.0	0.0	0.0	1210.9	7.6	0.0	0.0	0.0	0.0	1385.5	12.8	0.0	0.0	0.0	0.0	1385.5	12.8
	1991	212.7	4.9	0.0	0.0	5.5	0.0	2187.3	5.4	5.5	0.0	16.4	0.0	2400.0	10.2	5.5	0.0	21.8	0.0	2427.3	10.2
>5”	1984	81.7	43.1	0.0	0.0	0.4	0.2	78.2	33.3	0.0	0.0	0.0	0.0	159.9	76.3	0.0	0.0	0.4	0.2	160.3	76.5
	1991	77.0	47.6	1.0	0.7	1.9	1.3	91.7	45.1	1.5	0.5	9.8	3.6	168.7	92.7	2.4	1.3	11.7	4.9	182.8	98.9

Table 5b. Light-Medium Damage Stratum—Summary of Tree Conditions of Douglas-fir and Other Hosts as Recorded During the 1984 and 1991 Ground Surveys.

		Douglas-Fir						Combined Other Hosts						Combined All Hosts							
		Live		Dead Defol		Other		Live		Dead Defol		Other		Live		Dead Defol		Other Dead		All Conditions	
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5”	1984	190.9	1.4	0.0	0.0	5.5	0.1	1701.8	9.7	0.0	0.0	27.3	0.4	1892.7	11.1	0.0	0.0	32.7	0.5	**1925.5**	11.6
	1991	398.2	4.8	10.9	0.4	16.4	0.6	1254.5	8.6	70.9	1.2	65.5	1.1	1652.7	13.4	81.8	1.5	81.8	1.7	**1816.4**	16.6
>5”	1984	76.7	55.1	0.0	0.0	0.0	0.0	120.9	42.6	0.0	0.0	11.7	6.6	197.6	97.6	0.0	0.0	11.7	6.6	**209.3**	104.2
	1991	99.3	63.8	4.2	3.5	2.0	1.1	143.7	64.2	2.3	1.5	13.6	4.7	243.1	128.0	6.5	4.9	15.6	5.8	**265.3**	138.7

Table 5c. Heavy Damage Stratum—Summary of Tree Condition of Douglas-fir and Other Hosts as Recorded During the 1984 and 1991 Ground Surveys.

		Douglas-Fir						Combined Other Hosts						Combined All Hosts							
		Live		Dead Defol		Dead Other		Live		Dead Defol		Dead Other		Live		Dead Defol		Dead Other		All Conditions	
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5in.	1984	145.0	3.4	30.3	1.3	5.0	0.4	165.0	1.9	5.0	0.4	0.0	0.0	310.0	5.3	35.0	1.6	5.0	0.4	350.0	7.3
	1991	135.0	1.9	145.0	5.0	5.0	0.3	420.0	3.8	50.0	2.7	5.0	0.0	555.0	5.8	195.0	7.7	10.0	0.3	760.0	13.9
>5in.	1984	85.0	51.0	6.2	1.7	2.4	1.7	41.6	21.8	0.6	0.2	1.1	0.3	126.7	72.8	6.8	1.8	3.5	2.0	137.0	76.7
	1991	52.2	31.8	42.3	28.0	2.2	1.8	37.1	19.5	25.2	7.8	1.2	0.5	89.3	51.3	67.5	35.8	3.4	2.3	160.1	89.5

Table 5d. ***Dead Stratum—Summary of Tree Condition of Douglas-fir and Other Hosts as Recorded During the 1984 and 1991 Ground Surveys.***

		Douglas-Fir						Combined Other Hosts						Combined Other Hosts							
		Live		Dead Defol		Dead Other		Live		Dead Defol		Dead Other		Live		Dead Defol		Dead Other		All Conditions	
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5"	1984	334.4	3.0	85.7	4.6	34.3	0.9	3882.9	5.9	94.3	1.2	102.9	2.2	4217.1	9.0	180.0	5.8	137.1	3.0	4534.2	17.8
	1991	240.0	0.7	437.1	13.9	0.0	0.0	342.9	2.0	145.7	4.4	0.0	0.0	582.9	2.7	582.9	18.2	0.0	0.0	1165.7	21.0
>5"	1984	95.5	55.1	40.1	12.3	14.6	5.1	67.7	28.0	10.3	3.4	4.3	2.6	163.2	83.1	50.4	15.7	18.9	7.7	232.4	106.6
	1991	76.5	42.0	132.1	53.1	1.6	1.4	33.3	17.4	58.8	23.4	0.0	0.0	109.9	59.4	190.9	76.6	1.6	1.4	302.3	137.4

Table 5e. ***All Strata (Weighted)—Summary of Tree Condition of Douglas-fir and Other Hosts as Recorded During the 1984 and 1991 Ground Surveys.***

		Douglas-Fir						Combined Other Hosts						Combined All Hosts							
		Live		Dead Defol		Dead Other		Live		Dead Defol		Dead Other		Live		Dead Defol		Dead Other		All Conditions	
Dia.	Year	T/A	BA	T/A	BA	T/A	BA	T/AC	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA
<5"	1984	172.9	3.2	10.5	0.5	4.0	0.2	1089.5	6.6	2.5	0.1	11.4	0.2	1262.4	9.7	13.0	0.7	15.4	0.3	1290.8	10.6
	1991	257.7	3.8	55.6	1.9	9.4	0.3	1246.3	6.1	46.0	1.4	31.0	0.4	1504.1	9.9	101.5	3.3	40.4	0.7	1646.0	13.9
>5"	1984	81.0	50.3	2.4	0.7	1.0	0.7	82.6	33.1	0.3	0.1	4.8	2.6	163.6	83.4	2.7	0.7	5.9	3.3	172.1	87.4
	1991	77.4	48.6	16.9	11.1	2.0	1.4	93.1	43.7	10.1	3.5	8.3	3.0	170.4	92.3	27.0	14.6	10.4	4.4	207.8	111.3

Table 6. ***Summary of Reproduction Stocking (Trees Per Acre and Percent) by Strata, 1991.***

		Douglas-Fir			Other Hosts			Non Host	Grand Total			
Stratum		L 1/	DD 1/	DO 1/	L	DD	DO	L 2/	L	DD	DO	Total
1	T/A	212.7	0.0	0.0	2187.3	5.5	16.4	1690.9	4090.9	5.5	16.4	4112.8
	%	5.2	0.0	0.0	53.2	0.1	0.4	41.1	99.5	0.1	0.4	100.0
2	T/A	398.2	10.9	16.4	1254.5	76.9	65.5	1090.9	2743.6	87.8	81.9	2913.3
	%	13.7	0.4	0.6	43.1	2.6	2.2	37.4	94.2	3.0	2.8	100.0
3	T/A	135.0	145.0	5.0	420.0	50.0	5.0	615.0	1170.0	195.0	10.0	1375.0
	%	9.8	10.5	0.4	30.5	3.6	0.4	44.7	85.1	14.2	0.7	100.0
4	T/A	240.0	437.1	0.0	342.9	145.7	0.0	1457.1	2040.0	582.8	0.0	2622.8
	%	9.1	16.7	0.0	13.1	5.5	0.0	55.6	77.8	22.2	0.0	100.0
3/	T/A	259.7	55.6	9.4	1246.3	46.0	31.0	1115.5	2619.5	101.6	40.4	2761.5
AVE	%	9.3	2.0	0.3	45.1	1.7	1.1	40.4	94.8	3.7	1.5	100.0

1/ L, Live; DD, Dead from Defoliation; DO, Dead from Other Causes

2/ Only live trees recorded.

3/ Weighted proportionally by strata.

Table 7a. No Damage Stratum—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 8,100 Acres, Carson National Forest, 1991.

DIA CL	HOST SPECIES												TOTAL HOST			TOTAL NON-HOST *			TOTAL HOST & NON-HOST		
	DF			WF			ES			CBF											
	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A
<5	218.2	4.9	0.0	174.5	0.9	0.0	398.2	2.4	0.0	1636.4	2.1	0.0	2427.3	10.2	0.0	1690.9	6.4	0.0	4118.2	16.6	0.0
5	16.0	2.5	32.6	4.6	0.7	7.2	4.3	0.7	10.6	8.5	1.5	21.7	33.3	5.5	72.1	13.8	2.2	31.2	47.2	7.6	103.2
6	3.4	0.7	9.9	0.9	0.2	2.0	7.5	1.6	26.6	7.5	1.6	27.1	19.3	4.2	65.7	8.1	1.8	30.3	27.5	6.0	96.0
7	12.5	3.6	50.7	2.4	0.7	8.5	7.1	2.2	39.6	3.6	1.1	20.3	25.6	7.6	119.1	4.3	1.3	21.2	30.0	8.9	140.3
8	7.0	2.7	42.3	0.5	0.2	2.3	9.5	3.6	67.5	4.2	1.6	33.9	21.2	8.2	146.0	2.4	0.9	18.6	23.6	9.1	164.7
9	10.3	5.1	83.6	1.9	0.9	13.3	7.2	3.5	71.1	2.2	1.1	23.9	21.7	10.5	191.9	3.3	1.6	33.9	25.0	12.2	225.8
10	5.5	3.3	57.5	1.5	0.9	14.8	5.5	3.3	73.1	2.2	1.3	29.3	14.7	8.7	174.7	2.1	1.3	23.6	16.9	10.0	198.2
11	4.9	3.5	61.2	1.6	1.1	17.6	3.5	2.5	60.8	0.8	0.5	13.5	10.8	7.6	153.1	1.0	0.7	12.5	11.8	8.4	165.6
12	5.5	4.5	84.2	0.2	0.2	2.9	3.4	2.9	71.7	1.1	0.9	22.2	10.1	8.5	181.0	1.3	1.1	19.0	11.4	9.6	200.0
13	2.8	2.7	52.2	0.2	0.2	3.1	3.2	3.1	81.2	1.2	1.1	30.8	7.3	7.1	167.3	0.5	0.5	7.2	7.8	7.6	174.5
14	3.5	4.0	81.0	0.3	0.4	7.1	1.1	1.3	34.7	0.8	0.9	23.6	5.7	6.5	146.5	0.3	0.4	6.2	6.1	6.9	152.7
15	1.8	2.4	50.8	0.1	0.2	3.3	1.1	1.5	41.1	0.3	0.4	11.2	3.4	4.4	106.5	0.6	0.7	13.1	3.9	5.1	119.5
16+	6.6	14.5	368.5	0.9	1.6	32.2	1.9	3.5	109.5	0.2	0.4	12.9	9.6	20.0	523.2	1.7	3.9	86.8	11.3	23.9	609.9
SUBT 5+	79.8	49.6	974.5	15.2	7.3	114.4	55.2	29.6	687.7	32.6	12.4	270.4	182.8	98.9	2047.0	39.6	16.4	303.5	222.4	115.3	2350.5
TOTAL	298.0	54.5	974.5	189.7	8.1	114.4	453.4	32.0	687.7	1668.9	14.5	270.4	2610.1	109.2	2047.0	1730.5	22.8	303.5	4340.6	132.0	2350.5

* NON-HOST SPECIES - YELLOW PINE, BLACKJACK PINE, LIMBER PINE, ASPEN, PINYON-JUNIPER,COTTONWOOD, BRISTLECONE PINE, AND OTHER HARDWOODS

Table 7b. Light-Medium Damage Stratum—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 10,500 Acres, Carson National Forest, 1991.

DIA CL	HOST SPECIES												TOTAL HOST			TOTAL NON-HOST *			TOTAL HOST & NON-HOST		
	DF			WF			ES			CBF											
	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A
<5	425.5	5.7	0.0	180.0	1.9	0.0	420.0	2.1	0.0	790.9	6.9	0.0	1816.4	16.6	0.0	1090.9	3.4	0.0	2907.3	20.0	0.0
5	12.3	2.0	26.0	3.6	0.5	6.0	12.0	2.0	30.1	17.1	2.9	46.5	45.0	7.5	108.7	11.0	1.8	35.8	56.0	9.3	144.5
6	13.7	3.1	43.8	3.8	0.9	10.5	15.5	3.5	57.4	17.9	4.0	69.7	50.9	11.5	181.4	4.6	1.1	29.0	55.5	12.6	210.4
7	10.2	3.1	44.7	2.3	0.7	8.7	8.3	2.5	45.3	4.8	1.5	27.1	25.7	7.8	125.9	4.9	1.5	47.2	30.6	9.3	173.1
8	12.0	4.7	73.7	1.9	0.7	9.4	12.7	4.9	97.2	9.0	3.6	75.9	35.6	14.0	256.2	2.8	1.1	48.6	38.4	15.1	304.8
9	12.5	6.2	102.9	0.3	0.2	2.5	6.3	3.1	66.3	5.7	2.7	62.1	24.9	12.2	233.8	3.4	1.6	105.1	28.3	13.8	338.9
10	9.4	5.6	96.7	1.8	1.1	15.6	6.7	4.0	90.7	4.3	2.5	59.7	22.2	13.3	262.7	1.5	0.9	75.9	23.7	14.2	338.6
11	7.8	5.6	101.3	0.8	0.5	9.0	3.4	2.4	55.1	2.6	1.8	45.2	14.6	10.4	210.6	2.6	1.8	45.4	17.2	12.2	256.0
12	6.8	5.6	106.1	0.7	0.5	8.5	4.1	3.5	87.6	1.1	0.9	24.2	12.5	10.5	226.4	0.4	0.4	37.4	12.9	10.9	263.8
13	6.3	6.2	125.2	0.7	0.7	12.2	1.5	1.5	37.7	0.4	0.4	10.1	8.9	8.7	185.1	0.4	0.4	43.0	9.3	9.1	228.1
14	2.1	2.4	48.1	0.3	0.4	5.9	1.6	1.8	51.7	0.5	0.5	15.8	4.5	5.1	121.5	0.2	0.2	18.3	4.7	5.3	139.8
15	3.1	4.0	85.5	0.6	0.7	13.3	1.4	1.8	54.0	0.9	1.1	33.4	5.9	7.6	186.2	0.6	0.7	87.6	6.5	8.3	273.8
16+	9.6	19.8	490.8	1.1	1.8	38.3	3.9	8.4	304.8	0.1	0.2	5.8	14.6	30.2	839.7	0.9	1.6	345.6	15.5	31.8	1185.3
SUBT 5+	105.6	68.4	1344.8	18.0	8.9	139.9	77.4	39.3	977.8	64.3	22.2	475.6	265.3	138.7	2938.2	33.3	13.1	918.9	298.6	151.8	3857.1
TOTAL	531.0	74.1	1344.8	198.0	10.8	139.9	497.4	41.4	977.8	855.2	29.1	475.6	2081.6	155.4	2938.2	1124.2	16.5	918.9	3205.8	171.9	3857.1

* NON-HOST SPECIES - YELLOW PINE, BLACKJACK PINE, LIMBER PINE, ASPEN, PINYON-JUNIPER,COTTONWOOD, BRISTLECONE PINE, AND OTHER HARDWOODS

Table 7c. Heavy Damage Stratum—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 9,000 Acres, Carson National Forest, 1991.

DIA	HOST SPECIES												TOTAL HOST			TOTAL NON-HOST *			TOTAL HOST & NON-HOST		
	DF			WF			ES			CBF											
CL	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A
<5	285.0	7.3	0.0	435.0	6.5	0.0	40.0	0.0	0.0	0.0	0.0	0.0	760.0	13.9	0.0	615.0	2.0	0.0	1375.0	15.8	0.0
5	16.3	2.7	34.3	17.5	2.7	26.3	1.1	0.2	1.8	0.0	0.0	0.0	34.9	5.5	62.4	10.4	1.7	22.3	45.3	7.2	84.6
6	13.4	3.0	41.6	8.5	2.0	22.3	0.6	0.2	2.3	0.0	0.0	0.0	22.6	5.2	66.2	5.1	1.2	20.7	27.7	6.3	86.8
7	12.4	3.8	54.1	6.3	1.8	21.6	1.2	0.3	5.3	0.0	0.0	0.0	19.9	6.0	81.0	4.1	1.2	20.8	24.0	7.2	101.8
8	5.1	2.0	30.8	5.7	2.2	28.4	0.8	0.3	6.7	0.0	0.0	0.0	11.6	4.5	65.9	3.0	1.2	19.5	14.6	5.7	85.4
9	9.8	4.7	79.9	5.8	2.8	39.4	0.3	0.2	2.9	0.0	0.0	0.0	16.0	7.7	122.2	2.4	1.2	18.0	18.4	8.8	140.2
10	7.0	4.2	75.0	3.9	2.3	33.1	0.3	0.2	3.9	0.0	0.0	0.0	11.2	6.7	112.0	3.1	1.8	31.7	14.3	8.5	143.7
11	6.5	4.7	87.0	2.9	2.0	32.8	0.3	0.2	3.5	0.0	0.0	0.0	9.7	6.8	123.3	1.4	1.0	14.6	11.1	7.8	137.9
12	4.7	4.0	76.3	1.9	1.7	26.6	0.0	0.0	0.0	0.0	0.0	0.0	6.7	5.7	102.9	1.2	1.0	15.8	7.8	6.7	118.6
13	3.7	3.7	73.9	1.7	1.7	29.2	0.2	0.2	4.4	0.0	0.0	0.0	5.6	5.5	107.5	1.7	1.7	30.0	7.3	7.2	137.5
14	5.5	6.2	130.8	0.9	1.0	19.7	0.0	0.0	0.0	0.0	0.0	0.0	6.4	7.2	150.5	0.4	0.5	8.8	6.8	7.7	159.3
15	2.7	3.5	78.5	0.9	1.2	21.2	0.0	0.0	0.0	0.1	0.2	6.3	3.7	4.8	106.0	1.4	1.8	34.8	5.2	6.7	140.7
16+	9.6	19.3	484.7	2.3	4.5	90.8	0.1	0.2	4.9	0.0	0.0	0.0	12.0	24.0	580.4	3.2	6.5	152.9	15.2	30.5	733.3
SUBT 5+	96.6	61.7	1247.0	58.5	25.8	391.2	4.9	1.8	35.6	0.1	0.2	6.3	160.1	89.5	1680.2	37.4	20.7	389.8	197.5	110.2	2070.0
TOTAL	381.6	68.9	1247.0	493.5	32.4	391.2	44.9	1.9	35.6	0.1	0.2	6.3	920.1	103.4	1680.2	652.4	22.6	389.8	1572.5	126.0	2070.0

* NON-HOST SPECIES - YELLOW PINE, BLACKJACK PINE, LIMBER PINE, ASPEN, PINYON-JUNIPER,COTTONWOOD, BRISTLECONE PINE, AND OTHER HARDWOODS

Table 7d. Dead Stratum—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 300 Acres, Carson National Forest, 1991.

DIA	HOST SPECIES												TOTAL HOST			TOTAL NON-HOST *			TOTAL HOST & NON-HOST		
	DF			WF			ES			CBF											
CL	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A
<5	677.1	14.6	0.0	480.0	6.4	0.0	8.6	0.0	0.0	0.0	0.0	0.0	1165.7	21.0	0.0	1457.1	7.0	0.0	2622.9	28.0	0.0
5	45.0	7.1	93.5	18.9	3.1	31.0	1.7	0.3	7.3	1.9	0.3	3.8	67.6	10.9	135.6	15.4	2.6	42.6	83.0	13.4	178.3
6	36.1	8.0	108.5	17.9	4.0	44.1	0.0	0.0	0.0	0.0	0.0	0.0	54.0	12.0	152.6	10.1	2.3	38.1	64.1	14.3	190.7
7	37.5	11.4	165.5	16.6	4.9	57.4	0.0	0.0	0.0	0.0	0.0	0.0	54.1	16.3	222.9	3.8	1.1	22.7	57.8	17.4	245.6
8	14.2	5.4	80.9	6.7	2.6	33.1	0.0	0.0	0.0	0.0	0.0	0.0	20.9	8.0	114.1	6.9	2.6	50.2	27.8	10.6	164.2
9	20.1	9.7	156.9	5.3	2.6	34.6	0.0	0.0	0.0	0.0	0.0	0.0	25.4	12.3	191.5	5.4	2.6	52.2	30.8	14.9	243.7
10	14.9	8.9	151.7	3.8	2.3	33.0	0.0	0.0	0.0	0.0	0.0	0.0	18.7	11.1	184.7	1.5	0.9	16.9	20.2	12.0	201.6
11	11.2	8.0	144.9	4.0	2.9	43.3	0.4	0.3	6.2	0.0	0.0	0.0	15.7	11.1	194.5	1.2	0.9	19.0	16.8	12.0	213.5
12	9.0	7.7	146.2	3.4	2.9	45.6	0.3	0.3	7.1	0.0	0.0	0.0	12.8	10.9	198.9	0.7	0.6	10.3	13.5	11.4	209.2
13	6.7	6.6	132.6	3.2	3.1	55.2	0.0	0.0	0.0	0.0	0.0	0.0	9.9	9.7	187.8	0.9	0.9	23.1	10.7	10.6	210.9
14	4.5	5.1	109.3	3.7	4.3	77.2	0.0	0.0	0.0	0.0	0.0	0.0	8.2	9.4	186.5	1.0	1.1	24.2	9.2	10.6	210.7
15	3.6	4.6	97.2	1.8	2.3	42.8	0.0	0.0	0.0	0.0	0.0	0.0	5.3	6.9	140.0	0.7	0.9	30.2	6.0	7.7	170.2
16+	7.3	14.0	352.4	2.5	4.9	99.9	0.0	0.0	0.0	0.0	0.0	0.0	9.8	18.9	452.2	2.4	4.6	138.5	12.2	23.4	590.7
SUBT 5+	210.2	96.6	1739.5	87.8	39.7	597.2	2.5	0.9	20.7	1.9	0.3	3.8	302.3	137.4	2361.2	49.7	20.9	468.1	352.1	158.3	2829.3
TOTAL	887.3	111.2	1739.5	567.8	46.1	597.2	11.1	0.9	20.7	1.9	0.3	3.8	1468.1	158.4	2361.2	1506.9	27.9	468.1	2974.9	186.2	2829.3

* NON-HOST SPECIES - YELLOW PINE, BLACKJACK PINE, LIMBER PINE, ASPEN, PINYON-JUNIPER,COTTONWOOD, BRISTLECONE PINE, AND OTHER HARDWOODS

Table 7e. ***All Strata (Weighted by Area)—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 27,900 Acres, Carson National Forest, 1991.***

DIA	HOST SPECIES												TOTAL HOST			TOTAL NON-HOST *			TOTAL HOST & NON-HOST		
	DF			WF			ES			CBF											
CL	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A
<5	322.7	6.1	0.0	263.9	3.1	0.0	286.7	1.5	0.0	772.7	3.2	0.0	1646.0	13.9	0.0	1115.5	3.8	0.0	2761.5	17.8	0.0
5	15.0	2.4	31.3	8.5	1.3	13.2	6.1	1.0	15.1	8.9	1.5	23.9	38.6	6.3	83.4	11.7	1.9	30.2	50.3	8.2	113.6
6	10.8	2.4	34.0	4.7	1.1	12.2	8.2	1.8	30.1	8.9	2.0	34.1	32.6	7.3	110.3	5.8	1.3	26.8	38.5	8.7	137.1
7	11.9	3.6	50.8	3.8	1.1	13.3	5.6	1.7	30.3	2.9	0.9	16.1	24.1	7.3	110.5	4.5	1.3	30.9	28.6	8.6	141.4
8	8.4	3.3	50.8	2.8	1.1	13.7	7.8	3.0	58.3	4.6	1.8	38.4	23.5	9.2	161.3	2.8	1.1	30.5	26.3	10.3	191.8
9	11.1	5.4	90.5	2.6	1.3	17.9	4.6	2.2	46.5	2.8	1.3	30.3	21.1	10.3	185.1	3.1	1.5	55.8	24.2	11.7	240.9
10	7.5	4.5	78.9	2.4	1.5	21.2	4.2	2.5	56.6	2.3	1.3	31.0	16.4	9.8	187.7	2.2	1.3	45.8	18.6	11.1	233.5
11	6.6	4.7	85.5	1.7	1.2	19.6	2.4	1.7	39.6	1.2	0.8	20.9	11.9	8.4	165.6	1.7	1.2	25.6	13.6	9.7	191.2
12	5.7	4.8	90.6	1.0	0.8	13.1	2.5	2.1	53.9	0.7	0.6	15.5	9.9	8.4	173.1	0.9	0.8	24.8	10.8	9.2	197.9
13	4.4	4.4	87.6	0.9	0.9	15.5	1.6	1.5	39.2	0.5	0.5	12.7	7.4	7.2	154.9	0.9	0.9	28.2	8.3	8.1	183.1
14	3.6	4.1	85.0	0.5	0.6	11.5	0.9	1.1	29.5	0.4	0.5	12.8	5.5	6.2	138.8	0.3	0.4	11.8	5.8	6.6	150.6
15	2.6	3.4	73.3	0.6	0.7	13.3	0.8	1.1	32.3	0.4	0.6	17.9	4.5	5.8	136.7	0.9	1.1	48.3	5.3	6.8	185.0
16+	8.7	18.1	451.8	1.4	2.7	54.1	2.0	4.2	148.1	0.1	0.2	5.9	12.2	25.1	660.0	1.9	3.9	206.1	14.1	29.0	866.0
SUBT 5+	96.3	61.1	1210.0	31.0	14.2	218.5	46.7	24.0	579.4	33.7	12.0	259.6	207.8	111.3	2267.4	36.6	16.6	564.7	244.4	127.9	2832.1
TOTAL	419.0	67.1	1210.0	294.9	17.4	218.5	333.4	25.5	579.4	806.5	15.2	259.6	1853.8	125.2	2267.4	1152.1	20.4	564.7	3005.9	145.6	2832.1

* NON-HOST SPECIES - YELLOW PINE, BLACKJACK PINE, LIMBER PINE, ASPEN, PINYON-JUNIPER,COTTONWOOD, BRISTLECONE PINE, AND OTHER HARDWOODS

Table 8a. No Damage Stratum—Diameter Distribution and Condition of Douglas-fir and Other Host Tree Species (Trees/Acre and Basal Area/Acre) As Determined During the 1991 Ground Survey, Carson National Forest—8,100 Acres.

DIA	DOUGLAS-FIR									OTHER HOST SPECIES									TOTAL - ALL HOST SPECIES									ALL CONDITIONS		
	LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER					
CL	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	B/A	CF/A
<5	212.7	4.9	0.0	0.0	0.0	0.0	5.5	0.0	0.0	2187.3	5.4	0.0	5.5	0.0	0.0	16.4	0.0	0.0	2400.0	10.2	0.0	5.5	0.0	0.0	21.8	0.0	0.0	2427.3	10.2	0.0
5	16.0	2.5	32.6	0.0	0.0	0.0	0.0	0.0	0.0	16.2	2.7	36.6	0.0	0.0	0.0	1.1	0.2	2.9	32.2	5.3	69.2	0.0	0.0	0.0	1.1	0.2	2.9	33.3	5.5	72.1
6	3.4	0.7	9.9	0.0	0.0	0.0	0.0	0.0	0.0	12.5	2.7	43.7	0.8	0.2	3.0	2.6	0.5	9.1	15.9	3.5	53.6	0.8	0.2	3.0	2.6	0.5	9.1	19.3	4.2	65.7
7	11.8	3.5	48.1	0.7	0.2	2.6	0.0	0.0	0.0	11.8	3.6	61.9	0.0	0.0	0.0	1.4	0.4	6.5	23.6	7.1	110.0	0.7	0.2	2.6	1.4	0.4	6.5	25.6	7.6	119.1
8	7.0	2.7	42.3	0.0	0.0	0.0	0.0	0.0	0.0	12.6	4.9	93.1	0.0	0.0	0.0	1.5	0.5	10.6	19.7	7.6	135.4	0.0	0.0	0.0	1.5	0.5	10.6	21.2	8.2	146.0
9	9.6	4.7	77.6	0.0	0.0	0.0	0.7	0.4	6.0	9.5	4.5	88.9	0.4	0.2	3.8	1.5	0.7	15.6	19.1	9.3	166.5	0.4	0.2	3.8	2.2	1.1	21.6	21.7	10.5	191.9
10	5.2	3.1	54.3	0.0	0.0	0.0	0.3	0.2	3.2	8.3	4.9	106.1	0.3	0.2	2.7	0.6	0.4	8.4	13.5	8.0	160.4	0.3	0.2	2.7	0.9	0.5	11.6	14.7	8.7	174.7
11	4.4	3.1	54.6	0.0	0.0	0.0	0.5	0.4	6.5	5.4	3.8	83.2	0.0	0.0	0.0	0.5	0.4	8.8	9.7	6.9	137.8	0.0	0.0	0.0	1.0	0.7	15.3	10.8	7.6	153.1
12	5.2	4.4	80.8	0.0	0.0	0.0	0.2	0.2	3.4	4.7	4.0	96.8	0.0	0.0	0.0	0.0	0.0	0.0	9.9	8.4	177.6	0.0	0.0	0.0	0.2	0.2	3.4	10.1	8.5	181.0
13	2.8	2.7	52.2	0.0	0.0	0.0	0.0	0.0	0.0	4.1	4.0	105.1	0.0	0.0	0.0	0.4	0.4	10.0	6.9	6.7	157.4	0.0	0.0	0.0	0.4	0.4	10.0	7.3	7.1	167.3
14	3.3	3.8	77.3	0.2	0.2	3.8	0.0	0.0	0.0	2.1	2.4	60.1	0.0	0.0	0.0	0.2	0.2	5.4	5.4	6.2	137.4	0.2	0.2	3.8	0.2	0.2	5.4	5.7	6.5	146.5
15	1.7	2.2	47.0	0.0	0.0	0.0	0.1	0.2	3.9	1.6	2.0	55.6	0.0	0.0	0.0	0.0	0.0	0.0	3.2	4.2	102.6	0.0	0.0	0.0	0.1	0.2	3.9	3.4	4.4	106.5
16+	6.5	14.2	358.6	0.1	0.4	9.9	0.0	0.0	0.0	3.0	5.5	154.7	0.0	0.0	0.0	0.0	0.0	0.0	9.4	19.6	513.3	0.1	0.4	9.9	0.0	0.0	0.0	9.6	20.0	523.2
SUBT 5+	77.0	47.6	935.4	1.0	0.7	16.2	1.9	1.3	22.9	91.7	45.1	985.7	1.5	0.5	9.4	9.8	3.6	77.3	168.7	92.7	1921.1	2.4	1.3	25.7	11.7	4.9	100.2	182.8	98.9	2047.0
TOTAL	289.7	52.5	935.4	1.0	0.7	16.2	7.3	1.3	22.9	2279.0	50.5	985.7	6.9	0.5	9.4	26.2	3.7	77.3	2568.7	102.9	1921.1	7.9	1.3	25.7	33.5	4.9	100.2	2610.1	109.2	2047.0

Table 8b. Light-Medium Damage Stratum—Diameter Distribution and Condition of Douglas-fir and Other Host Tree Species (Trees/Acre and Basal Area/Acre) As Determined During the 1991 Ground Survey, Carson National Forest—10,500 Acres.

DIA	DOUGLAS-FIR									OTHER HOST SPECIES									TOTAL - ALL HOST SPECIES									ALL CONDITIONS		
	LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER					
CL	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	B/A	CF/A
<5	398.2	4.8	0.0	10.9	0.4	0.0	16.4	0.6	0.0	1254.5	8.6	0.0	70.9	1.2	0.0	65.5	1.1	0.0	1652.7	13.4	0.0	81.8	1.5	0.0	81.8	1.7	0.0	1816.4	16.6	0.0
5	12.3	2.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	29.5	4.9	74.2	0.0	0.0	0.0	3.2	0.5	8.5	41.7	6.9	100.2	0.0	0.0	0.0	3.2	0.5	8.5	45.0	7.5	108.7
6	11.1	2.5	36.4	1.8	0.4	4.9	0.8	0.2	2.5	34.7	7.8	128.4	0.0	0.0	0.0	2.6	0.5	9.2	45.7	10.4	164.9	1.8	0.4	4.9	3.4	0.7	11.7	50.9	11.5	181.4
7	10.2	3.1	44.7	0.0	0.0	0.0	0.0	0.0	0.0	12.4	3.8	64.5	0.0	0.0	0.0	3.1	0.9	16.7	22.6	6.9	109.2	0.0	0.0	0.0	3.1	0.9	16.7	25.7	7.8	125.9
8	12.0	4.7	73.7	0.0	0.0	0.0	0.0	0.0	0.0	21.4	8.4	164.1	0.5	0.2	3.7	1.7	0.7	14.7	33.4	13.1	237.8	0.5	0.2	3.7	1.7	0.7	14.7	35.6	14.0	256.2
9	12.2	6.0	99.9	0.4	0.2	3.0	0.0	0.0	0.0	11.2	5.5	119.2	0.8	0.4	7.8	0.4	0.2	3.8	23.3	11.5	219.1	1.1	0.5	10.8	0.4	0.2	3.8	24.9	12.2	233.8
10	8.5	5.1	87.4	0.3	0.2	3.1	0.6	0.4	6.2	11.2	6.7	144.9	0.0	0.0	0.0	1.6	0.9	21.1	19.7	11.8	232.3	0.3	0.2	3.1	2.2	1.3	27.3	22.2	13.3	262.7
11	7.6	5.5	98.0	0.2	0.2	3.3	0.0	0.0	0.0	5.7	4.0	91.6	0.5	0.4	8.7	0.5	0.4	9.1	13.3	9.5	189.6	0.8	0.5	12.0	0.5	0.4	9.1	14.6	10.4	210.6
12	6.1	5.1	95.7	0.2	0.2	3.5	0.4	0.4	6.9	5.2	4.4	107.7	0.4	0.4	7.8	0.2	0.2	4.8	11.3	9.5	203.4	0.6	0.5	11.3	0.6	0.5	11.7	12.5	10.5	226.4
13	6.3	6.2	125.2	0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.5	60.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	8.7	185.1	0.0	0.0	0.0	0.0	0.0	0.0	8.9	8.7	185.1
14	1.8	2.0	40.5	0.3	0.4	7.6	0.0	0.0	0.0	2.4	2.7	73.3	0.0	0.0	0.0	0.0	0.0	0.0	4.2	4.7	113.8	0.3	0.4	7.6	0.0	0.0	0.0	4.5	5.1	121.5
15	2.9	3.8	81.6	0.1	0.2	3.8	0.0	0.0	0.0	2.5	3.3	89.8	0.1	0.2	5.4	0.1	0.2	5.6	5.5	7.1	171.5	0.3	0.4	9.2	0.1	0.2	5.6	5.9	7.6	186.2
16+	8.5	17.8	441.6	0.9	1.8	45.1	0.1	0.2	4.0	4.9	10.2	343.4	0.0	0.0	0.0	0.1	0.2	5.5	13.4	28.0	785.0	0.9	1.8	45.1	0.3	0.4	9.5	14.6	30.2	839.7
SUBT 5+	99.3	63.8	1250.8	4.2	3.5	74.4	2.0	1.1	19.6	143.7	64.2	1461.0	2.3	1.5	33.4	13.6	4.7	99.0	243.1	128.0	2711.7	6.5	4.9	107.8	15.6	5.8	118.6	265.3	138.7	2938.2
TOTAL	497.5	68.6	1250.8	15.1	3.8	74.4	18.4	1.6	19.6	1398.3	72.8	1461.0	73.2	2.6	33.4	79.1	5.9	99.0	1895.8	141.4	2711.7	88.4	6.5	107.8	97.4	7.5	118.6	2081.6	155.4	2938.2

Table 8c. ***Heavy Damage Stratum—Diameter Distribution and Condition of Douglas-fir and Other Host Tree Species (Trees/Acre and Basal Area/Acre) as Determined During the 1991 Ground Survey, Carson National Forest—9,000 Acres.***

	DOUGLAS-FIR									OTHER HOST SPECIES									TOTAL - ALL HOST SPECIES									ALL CONDITIONS		
DIA	LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER					
CL	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	B/A	CF/A
<5	135.0	1.9	0.0	145.0	5.0	0.0	5.0	0.3	0.0	420.0	3.8	0.0	50.0	2.7	0.0	5.0	0.0	0.0	555.0	5.8	0.0	195.0	7.7	0.0	10.0	0.3	0.0	760.0	13.9	0.0
5	10.2	1.7	21.2	6.1	1.0	13.1	0.0	0.0	0.0	7.7	1.2	11.0	11.0	1.7	17.1	0.0	0.0	0.0	17.9	2.8	32.2	17.0	2.7	30.2	0.0	0.0	0.0	34.9	5.5	62.4
6	8.2	1.8	25.7	5.2	1.2	16.0	0.0	0.0	0.0	3.3	0.8	9.7	5.2	1.2	13.0	0.7	0.2	1.9	11.5	2.7	35.3	10.4	2.3	29.0	0.7	0.2	1.9	22.6	5.2	66.2
7	4.2	1.3	17.7	8.2	2.5	36.4	0.0	0.0	0.0	4.8	1.3	16.9	2.8	0.8	9.9	0.0	0.0	0.0	9.0	2.7	34.7	10.9	3.3	46.4	0.0	0.0	0.0	19.9	6.0	81.0
8	2.5	1.0	15.4	2.1	0.8	12.8	0.4	0.2	2.6	4.7	1.8	26.7	1.8	0.7	8.4	0.0	0.0	0.0	7.2	2.8	42.1	3.9	1.5	21.2	0.4	0.2	2.6	11.6	4.5	65.9
9	6.3	3.0	53.0	2.8	1.3	21.5	0.7	0.3	5.4	4.5	2.2	30.9	1.3	0.7	9.1	0.4	0.2	2.2	10.7	5.2	83.9	4.2	2.0	30.6	1.1	0.5	7.6	16.0	7.7	122.2
10	3.6	2.2	40.6	3.0	1.8	31.5	0.3	0.2	2.8	3.1	1.8	27.2	1.1	0.7	9.8	0.0	0.0	0.0	6.8	4.0	67.8	4.1	2.5	41.3	0.3	0.2	2.8	11.2	6.7	112.0
11	3.8	2.7	50.9	2.5	1.8	33.1	0.2	0.2	3.1	2.7	1.8	31.2	0.5	0.3	5.1	0.0	0.0	0.0	6.4	4.5	82.1	3.0	2.2	38.2	0.2	0.2	3.1	9.7	6.8	123.3
12	2.7	2.3	45.3	2.0	1.7	30.9	0.0	0.0	0.0	1.2	1.0	15.8	0.8	0.7	10.8	0.0	0.0	0.0	3.9	3.3	61.1	2.7	2.3	41.7	0.0	0.0	0.0	6.7	5.7	102.9
13	2.4	2.3	47.5	1.3	1.3	26.5	0.0	0.0	0.0	1.5	1.5	28.0	0.3	0.3	5.5	0.0	0.0	0.0	3.9	3.8	75.4	1.7	1.7	32.0	0.0	0.0	0.0	5.6	5.5	107.5
14	2.7	3.0	65.7	2.7	3.0	61.7	0.1	0.2	3.5	0.7	0.8	16.8	0.2	0.2	2.9	0.0	0.0	0.0	3.4	3.8	82.5	2.8	3.2	64.6	0.1	0.2	3.5	6.4	7.2	150.5
15	1.3	1.7	39.3	1.3	1.7	35.7	0.1	0.2	3.5	0.8	1.0	21.5	0.3	0.3	6.0	0.0	0.0	0.0	2.1	2.7	60.8	1.6	2.0	41.7	0.1	0.2	3.5	3.7	4.8	106.0
16+	4.3	8.8	223.7	5.0	9.8	244.1	0.3	0.7	17.0	2.1	4.2	84.9	0.2	0.3	7.5	0.1	0.2	3.2	6.4	13.0	308.7	5.1	10.2	251.6	0.4	0.8	20.1	12.0	24.0	580.4
SUBT 5+	52.2	31.8	646.0	42.3	28.0	563.3	2.2	1.8	37.8	37.1	19.5	320.7	25.2	7.8	105.2	1.2	0.5	7.3	89.3	51.3	966.6	67.5	35.8	668.5	3.4	2.3	45.1	160.1	89.5	1680.2
TOTAL	187.2	33.8	646.0	187.3	33.0	563.3	7.2	2.2	37.8	457.1	23.3	320.7	75.2	10.6	105.2	6.2	0.5	7.3	644.3	57.1	966.6	262.5	43.6	668.5	13.4	2.7	45.1	920.1	103.4	1680.2

Table 8d. ***Dead Stratum—Diameter Distribution and Condition of Douglas-fir and Other Host Tree Species (Trees/Acre and Basal Area/Acre) as Determined During the 1991 Ground Survey, Carson National Forest—300 Acres.***

	DOUGLAS-FIR									OTHER HOST SPECIES									TOTAL - ALL HOST SPECIES									ALL CONDITIONS		
DIA	LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER					
CL	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	B/A	CF/A
<5	240.0	0.7	0.0	437.1	13.9	0.0	0.0	0.0	0.0	342.9	2.0	0.0	145.7	4.4	0.0	0.0	0.0	0.0	582.9	2.7	0.0	582.9	18.2	0.0	0.0	0.0	0.0	1165.7	21.0	0.0
5	5.2	0.9	11.3	39.8	6.3	82.2	0.0	0.0	0.0	11.0	1.7	21.2	11.6	2.0	21.0	0.0	0.0	0.0	16.2	2.6	32.4	51.4	8.3	103.2	0.0	0.0	0.0	67.6	10.9	135.6
6	10.4	2.3	30.2	25.7	5.7	78.3	0.0	0.0	0.0	5.1	1.1	12.4	12.8	2.9	31.7	0.0	0.0	0.0	15.6	3.4	42.6	38.4	8.6	110.0	0.0	0.0	0.0	54.0	12.0	152.6
7	14.8	4.6	66.0	22.7	6.9	99.6	0.0	0.0	0.0	3.8	1.1	13.4	12.8	3.7	43.9	0.0	0.0	0.0	18.6	5.7	79.4	35.5	10.6	143.5	0.0	0.0	0.0	54.1	16.3	222.9
8	6.8	2.6	37.0	7.4	2.9	43.9	0.0	0.0	0.0	1.5	0.6	7.5	5.1	2.0	25.6	0.0	0.0	0.0	8.4	3.1	44.6	12.5	4.9	69.5	0.0	0.0	0.0	20.9	8.0	114.1
9	10.7	5.1	82.7	9.4	4.6	74.2	0.0	0.0	0.0	1.1	0.6	7.6	4.2	2.0	27.0	0.0	0.0	0.0	11.8	5.7	90.3	13.6	6.6	101.2	0.0	0.0	0.0	25.4	12.3	191.5
10	6.7	4.0	68.4	8.2	4.9	83.3	0.0	0.0	0.0	0.5	0.3	4.1	3.3	2.0	28.9	0.0	0.0	0.0	7.2	4.3	72.5	11.5	6.9	112.2	0.0	0.0	0.0	18.7	11.1	184.7
11	7.7	5.4	98.4	3.1	2.3	41.4	0.4	0.3	5.0	2.0	1.4	23.5	2.4	1.7	26.1	0.0	0.0	0.0	9.7	6.9	121.9	5.6	4.0	67.5	0.4	0.3	5.0	15.7	11.1	194.5
12	4.4	3.7	70.2	3.9	3.4	65.3	0.7	0.6	10.6	1.7	1.4	25.4	2.1	1.7	27.3	0.0	0.0	0.0	6.1	5.1	95.6	6.0	5.1	92.6	0.7	0.6	10.6	12.8	10.9	198.9
13	3.8	3.7	76.2	2.9	2.9	56.4	0.0	0.0	0.0	1.8	1.7	31.0	1.4	1.4	24.2	0.0	0.0	0.0	5.5	5.4	107.2	4.3	4.3	80.6	0.0	0.0	0.0	9.9	9.7	187.8
14	1.5	1.7	38.4	2.7	3.1	64.9	0.2	0.3	5.9	2.0	2.3	41.9	1.7	2.0	35.3	0.0	0.0	0.0	3.5	4.0	80.3	4.5	5.1	100.2	0.2	0.3	5.9	8.2	9.4	186.5
15	0.9	1.1	23.9	2.4	3.1	67.1	0.2	0.3	6.2	1.1	1.4	27.2	0.7	0.9	15.6	0.0	0.0	0.0	2.0	2.6	51.1	3.1	4.0	82.7	0.2	0.3	6.2	5.3	6.9	140.0
16+	3.6	6.9	177.7	3.8	7.1	174.7	0.0	0.0	0.0	1.8	3.7	77.2	0.7	1.1	22.6	0.0	0.0	0.0	5.4	10.6	254.9	4.5	8.3	197.3	0.0	0.0	0.0	9.8	18.9	452.2
SUBT 5+	76.5	42.0	780.4	132.1	53.1	931.3	1.6	1.4	27.8	33.3	17.4	292.5	58.8	23.4	329.2	0.0	0.0	0.0	109.9	59.4	1072.9	190.9	76.6	1260.5	1.6	1.4	27.8	302.3	137.4	2361.2
TOTAL	316.5	42.7	780.4	569.2	67.0	931.3	1.6	1.4	27.8	376.2	19.4	292.5	204.6	27.8	329.2	0.0	0.0	0.0	692.7	62.1	1072.9	773.8	94.8	1260.5	1.6	1.4	27.8	1468.1	158.4	2361.2

Table 8e. *All Strata (Weighted by Area)—Diameter Distribution and Condition of Douglas-fir and Other Host Tree Species (Trees/Acre and Basal Area/Acre) as Determined During the 1991 Ground Survey, Carson National Forest — 27,900 Acres.*

DIA	DOUGLAS-FIR									OTHER HOST SPECIES									TOTAL - ALL HOST SPECIES									ALL CONDITIONS		
	LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER			LIVE			DEAD-DEFOL.			DEAD-OTHER					
CL	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	BA/A	CF/A	T/A	B/A	CF/A
<5	257.7	3.8	0.0	55.6	1.9	0.0	9.4	0.3	0.0	1246.3	6.1	0.0	46.0	1.4	0.0	31.0	0.4	0.0	1504.1	9.9	0.0	101.5	3.3	0.0	40.4	0.7	0.0	1646.0	13.9	0.0
5	12.6	2.0	26.2	2.4	0.4	5.1	0.0	0.0	0.0	18.4	3.0	42.3	3.7	0.6	5.7	1.5	0.3	4.0	31.0	5.1	68.5	6.0	0.9	10.8	1.5	0.3	4.0	38.6	6.3	83.4
6	7.9	1.8	25.2	2.6	0.6	7.9	0.3	0.1	0.9	17.8	4.0	64.3	2.0	0.5	5.4	1.9	0.4	6.7	25.7	5.8	89.5	4.7	1.0	13.2	2.3	0.5	7.6	32.6	7.3	110.3
7	8.8	2.6	37.2	3.1	0.9	13.6	0.0	0.0	0.0	9.7	2.9	47.8	1.0	0.3	3.7	1.6	0.4	8.2	18.4	5.6	85.1	4.1	1.2	17.2	1.6	0.4	8.2	24.1	7.3	110.5
8	7.5	2.9	45.4	0.8	0.3	4.6	0.1	0.1	0.8	13.3	5.2	97.5	0.8	0.3	4.4	1.1	0.4	8.6	20.7	8.1	142.9	1.6	0.6	9.0	1.2	0.5	9.4	23.5	9.2	161.3
9	9.5	4.7	78.1	1.1	0.5	8.9	0.4	0.2	3.5	8.4	4.1	80.7	0.9	0.4	7.3	0.7	0.3	6.7	17.9	8.7	158.8	2.0	1.0	16.1	1.1	0.5	10.2	21.1	10.3	185.1
10	5.9	3.6	62.5	1.2	0.7	12.2	0.4	0.2	4.2	7.7	4.6	94.2	0.5	0.3	4.3	0.8	0.4	10.4	13.6	8.1	156.7	1.6	1.0	16.5	1.2	0.7	14.6	16.4	9.8	187.7
11	5.4	3.9	70.2	0.9	0.7	12.4	0.2	0.2	2.9	4.6	3.2	68.9	0.4	0.3	5.2	0.3	0.2	6.0	10.0	7.1	139.1	1.3	0.9	17.5	0.6	0.4	8.9	11.9	8.4	165.6
12	4.8	4.0	74.9	0.8	0.6	12.0	0.2	0.2	3.7	3.7	3.1	74.0	0.4	0.4	6.7	0.1	0.1	1.8	8.4	7.1	148.8	1.2	1.0	18.7	0.3	0.3	5.5	9.9	8.4	173.1
13	4.0	3.9	78.4	0.5	0.5	9.2	0.0	0.0	0.0	2.7	2.6	62.4	0.1	0.1	2.0	0.1	0.1	2.9	6.7	6.5	140.8	0.6	0.6	11.2	0.1	0.1	2.9	7.4	7.2	154.9
14	2.5	2.8	59.3	1.0	1.2	24.6	0.0	0.1	1.2	1.8	2.0	50.9	0.1	0.1	1.3	0.0	0.1	1.6	4.3	4.9	110.2	1.1	1.3	25.9	0.1	0.1	2.7	5.5	6.2	138.8
15	2.0	2.6	57.3	0.5	0.6	13.7	0.1	0.1	2.3	1.7	2.2	57.2	0.1	0.2	4.1	0.1	0.1	2.1	3.7	4.8	114.5	0.6	0.8	17.8	0.1	0.2	4.4	4.5	5.8	136.7
16+	6.5	13.7	344.4	2.0	4.0	100.5	0.1	0.3	7.0	3.4	6.8	202.4	0.1	0.1	2.7	0.1	0.1	3.1	9.9	20.5	546.8	2.1	4.2	103.1	0.2	0.4	10.1	12.2	25.1	660.0
SUBT 5+	77.4	48.6	959.0	16.9	11.1	224.5	2.0	1.4	26.5	93.1	43.7	942.6	10.1	3.5	52.8	8.3	3.0	62.1	170.4	92.3	1901.7	27.0	14.6	277.2	10.4	4.4	88.6	207.8	111.3	2267.4
TOTAL	335.1	52.4	959.0	72.5	13.0	224.5	11.4	1.7	26.5	1339.4	49.8	942.6	56.0	4.8	52.8	39.3	3.4	62.1	1674.5	102.2	1901.7	128.5	17.9	277.2	50.7	5.1	88.6	1853.8	125.2	2267.4

Table 9a. No Damage Stratum—Damage Intensity Following A Spruce Budworm Outbreak By Live Douglas-fir and Other Host Species, 8,100 Acres, Carson National Forest, 1991.

DIA CL	DOUGLAS-FIR CROWN DAMAGE								OTHER HOST SPECIES CROWN DAMAGE								TOTAL ALL HOST SPECIES CROWN DAMAGE								GRAND TOT	
	NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY			
	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A
<5	180.0	3.2	21.8	1.1	10.9	0.6	0.0	0.0	2154.5	4.2	21.8	0.8	5.5	0.2	5.5	0.2	2334.5	7.4	43.6	1.9	16.4	0.8	5.5	0.2	2400.0	10.2
5	10.4	1.6	4.5	0.7	1.2	0.2	0.0	0.0	9.7	1.6	6.5	1.1	0.0	0.0	0.0	0.0	20.1	3.3	11.0	1.8	1.2	0.2	0.0	0.0	32.2	5.3
6	1.5	0.4	1.8	0.4	0.0	0.0	0.0	0.0	12.5	2.7	0.0	0.0	0.0	0.0	0.0	0.0	14.0	3.1	1.8	0.4	0.0	0.0	0.0	0.0	15.9	3.5
7	5.5	1.6	5.1	1.5	1.3	0.4	0.0	0.0	8.9	2.7	1.7	0.5	1.1	0.4	0.0	0.0	14.4	4.4	6.8	2.0	2.4	0.7	0.0	0.0	23.6	7.1
8	3.3	1.3	2.8	1.1	1.0	0.4	0.0	0.0	9.0	3.5	2.7	1.1	0.9	0.4	0.0	0.0	12.3	4.7	5.5	2.2	1.9	0.7	0.0	0.0	19.7	7.6
9	5.1	2.5	4.1	2.0	0.0	0.0	0.4	0.2	6.7	3.3	1.6	0.7	1.1	0.5	0.0	0.0	11.9	5.8	5.7	2.7	1.1	0.5	0.4	0.2	19.1	9.3
10	3.3	2.0	1.6	0.9	0.3	0.2	0.0	0.0	4.6	2.7	3.4	2.0	0.3	0.2	0.0	0.0	7.9	4.7	5.0	2.9	0.6	0.4	0.0	0.0	13.5	8.0
11	2.8	2.0	0.8	0.5	0.8	0.5	0.0	0.0	1.3	0.9	3.0	2.2	1.0	0.7	0.0	0.0	4.1	2.9	3.8	2.7	1.8	1.3	0.0	0.0	9.7	6.9
12	2.6	2.2	2.4	2.0	0.2	0.2	0.0	0.0	1.7	1.5	2.7	2.4	0.2	0.2	0.0	0.0	4.3	3.6	5.1	4.4	0.4	0.4	0.0	0.0	9.9	8.4
13	1.3	1.3	1.3	1.3	0.2	0.2	0.0	0.0	1.9	1.8	1.9	1.8	0.4	0.4	0.0	0.0	3.2	3.1	3.2	3.1	0.5	0.5	0.0	0.0	6.9	6.7
14	1.9	2.2	0.8	0.9	0.8	0.9	0.0	0.0	0.8	0.9	1.1	1.3	0.2	0.2	0.0	0.0	2.7	3.1	1.9	2.2	1.0	1.1	0.0	0.0	5.6	6.4
15	0.9	1.1	0.8	1.1	0.0	0.0	0.0	0.0	0.8	1.1	0.4	0.5	0.3	0.4	0.0	0.0	1.7	2.2	1.2	1.6	0.3	0.4	0.0	0.0	3.2	4.2
16+	3.0	6.2	2.9	6.7	0.6	1.3	0.0	0.0	1.3	2.4	1.4	2.7	0.2	0.4	0.0	0.0	4.4	8.5	4.3	9.5	0.8	1.6	0.0	0.0	9.4	19.6
SUBT 5+	41.6	24.4	28.8	19.1	6.3	4.2	0.4	0.2	59.3	25.1	26.6	16.4	5.7	3.6	0.0	0.0	101.0	49.5	55.5	35.5	12.0	7.8	0.4	0.2	168.8	92.9
TOTAL	221.6	27.5	50.6	20.2	17.2	4.8	0.4	0.2	2213.9	29.3	48.5	17.1	11.2	3.8	5.5	0.2	2435.5	56.8	99.1	37.3	28.4	8.6	5.8	0.4	2568.8	103.1

Table 9b. Light-Medium Damage Stratum—Damage Intensity Following A Spruce Budworm Outbreak by Live Douglas-fir and Other Host Species, 10,500 Acres, Carson National Forest, 1991.

DIA CL	DOUGLAS-FIR CROWN DAMAGE								OTHER HOST SPECIES CROWN DAMAGE								TOTAL ALL HOST SPECIES CROWN DAMAGE								GRAND TOT	
	NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY			
	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A
<5	310.9	1.4	43.6	1.6	16.4	0.0	27.3	1.8	1080.0	6.0	109.1	1.7	43.6	0.4	21.8	0.6	1390.9	7.3	152.7	3.2	60.0	0.4	49.1	2.4	1652.7	13.4
5	1.1	0.2	5.7	0.9	4.5	0.7	1.0	0.2	21.7	3.6	5.7	0.9	1.0	0.2	1.1	0.2	22.8	3.8	11.4	1.8	5.4	0.9	2.1	0.4	41.7	6.9
6	1.6	0.4	2.4	0.5	5.6	1.3	1.4	0.4	22.4	5.1	7.4	1.6	4.8	1.1	0.0	0.0	24.1	5.5	9.8	2.2	10.4	2.4	1.4	0.4	45.7	10.4
7	1.2	0.4	2.4	0.7	3.6	1.1	3.0	0.9	7.2	2.2	3.9	1.3	1.2	0.4	0.0	0.0	8.4	2.5	6.3	2.0	4.9	1.5	3.0	0.9	22.6	6.9
8	2.8	1.1	4.6	1.8	2.7	1.1	1.9	0.7	14.4	5.6	3.7	1.5	2.8	1.1	0.5	0.2	17.1	6.7	8.4	3.3	5.6	2.2	2.4	0.9	33.4	13.1
9	1.5	0.7	6.6	3.3	3.7	1.8	0.4	0.2	7.4	3.6	1.8	0.9	1.6	0.7	0.3	0.2	8.9	4.4	8.5	4.2	5.2	2.5	0.7	0.4	23.3	11.5
10	1.2	0.7	4.0	2.4	2.4	1.5	0.9	0.5	9.4	5.6	0.9	0.5	0.9	0.5	0.0	0.0	10.6	6.4	4.9	2.9	3.3	2.0	0.9	0.5	19.7	11.8
11	1.3	0.9	4.5	3.3	1.5	1.1	0.2	0.2	4.7	3.3	0.8	0.5	0.3	0.2	0.0	0.0	6.0	4.2	5.3	3.8	1.8	1.3	0.2	0.2	13.3	9.5
12	2.2	1.8	2.8	2.4	1.1	0.9	0.0	0.0	3.0	2.5	1.3	1.1	0.9	0.7	0.0	0.0	5.2	4.4	4.1	3.5	2.0	1.6	0.0	0.0	11.3	9.5
13	1.8	1.8	3.2	3.1	0.9	0.9	0.4	0.4	1.7	1.6	0.6	0.5	0.4	0.4	0.0	0.0	3.5	3.5	3.7	3.6	1.3	1.3	0.4	0.4	8.9	8.7
14	0.8	0.9	1.0	1.1	0.0	0.0	0.0	0.0	2.1	2.4	0.3	0.4	0.0	0.0	0.0	0.0	2.9	3.3	1.3	1.5	0.0	0.0	0.0	0.0	4.2	4.7
15	0.8	1.1	1.5	2.0	0.4	0.5	0.1	0.2	1.5	2.0	0.7	0.9	0.3	0.4	0.0	0.0	2.4	3.1	2.2	2.9	0.7	0.9	0.1	0.2	5.5	7.1
16+	2.1	4.5	3.7	7.5	1.8	3.8	0.9	2.0	3.3	7.5	0.8	1.5	0.7	1.1	0.1	0.2	5.4	12.0	4.6	8.9	2.5	4.9	1.0	2.2	13.4	28.0
SUBT 5+	18.3	14.5	42.5	28.9	28.3	14.7	10.2	5.6	98.9	45.1	28.0	11.6	14.8	6.7	2.0	0.7	117.2	59.6	70.5	40.5	43.1	21.5	12.3	6.4	243.1	128.0
TOTAL	329.2	15.9	86.1	30.5	44.7	14.7	37.5	7.5	1178.9	51.0	137.1	13.3	58.4	7.2	23.9	1.3	1508.1	67.0	223.3	43.8	103.1	21.9	61.4	8.8	1895.8	141.4

Table 9c. Heavy Damage Stratum—Damage Intensity Following A Spruce Budworm Outbreak by Live Douglas-fir and Other Host Species, 9,000 Acres, Carson National Forest, 1991.

DIA CL	DOUGLAS-FIR CROWN DAMAGE								OTHER HOST SPECIES CROWN DAMAGE								TOTAL ALL HOST SPECIES CROWN DAMAGE								GRAND TOT	
	NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY			
	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A
<5	95.0	0.1	25.0	1.3	10.0	0.6	5.0	0.0	385.0	3.0	20.0	0.4	0.0	0.0	15.0	0.4	480.0	3.1	45.0	1.7	10.0	0.6	20.0	0.4	555.0	5.8
5	2.1	0.3	2.0	0.3	4.0	0.7	2.1	0.3	6.5	1.0	1.1	0.2	0.0	0.0	0.0	0.0	8.6	1.3	3.1	0.5	4.0	0.7	2.1	0.3	17.9	2.8
6	0.8	0.2	1.5	0.3	3.7	0.8	2.2	0.5	1.3	0.3	0.6	0.2	1.4	0.3	0.0	0.0	2.1	0.5	2.1	0.5	5.1	1.2	2.2	0.5	11.5	2.7
7	1.5	0.5	1.7	0.5	1.0	0.3	0.0	0.0	3.6	1.0	0.6	0.2	0.0	0.0	0.5	0.2	5.1	1.5	2.3	0.7	1.0	0.3	0.5	0.2	9.0	2.7
8	0.4	0.2	1.3	0.5	0.5	0.2	0.4	0.2	0.4	0.2	2.5	1.0	0.5	0.2	1.3	0.5	0.8	0.3	3.7	1.5	0.9	0.3	1.7	0.7	7.2	2.8
9	0.0	0.0	3.9	1.8	0.6	0.3	1.8	0.8	2.1	1.0	0.3	0.2	1.7	0.8	0.3	0.2	2.1	1.0	4.2	2.0	2.4	1.2	2.1	1.0	10.7	5.2
10	0.3	0.2	1.4	0.8	1.3	0.8	0.6	0.3	1.1	0.7	0.6	0.3	1.5	0.8	0.0	0.0	1.4	0.8	2.0	1.2	2.8	1.7	0.6	0.3	6.8	4.0
11	0.0	0.0	1.9	1.3	1.4	1.0	0.5	0.3	1.2	0.8	0.5	0.3	0.7	0.5	0.3	0.2	1.2	0.8	2.4	1.7	2.1	1.5	0.7	0.5	6.4	4.5
12	0.4	0.3	0.4	0.3	1.2	1.0	0.8	0.7	0.4	0.3	0.4	0.3	0.4	0.3	0.0	0.0	0.8	0.7	0.8	0.7	1.6	1.3	0.8	0.7	3.9	3.3
13	0.8	0.8	0.5	0.5	0.3	0.3	0.7	0.7	0.2	0.2	0.7	0.7	0.5	0.5	0.2	0.2	1.0	1.0	1.2	1.2	0.8	0.8	0.8	0.8	3.9	3.8
14	0.7	0.8	1.0	1.2	1.0	1.2	0.1	0.2	0.2	0.2	0.6	0.7	0.0	0.0	0.0	0.0	0.9	1.0	1.6	1.8	1.0	1.2	0.1	0.2	3.7	4.2
15	0.0	0.0	0.9	1.2	0.1	0.2	0.2	0.3	0.1	0.2	0.3	0.3	0.3	0.3	0.1	0.2	0.1	0.2	1.2	1.5	0.4	0.5	0.4	0.5	2.1	2.7
16+	1.2	2.3	2.2	4.7	0.6	1.2	0.4	0.7	0.6	1.2	0.8	1.5	0.6	1.3	0.1	0.2	1.7	3.5	3.0	6.2	1.2	2.5	0.5	0.8	6.4	13.0
SUBT 5+	8.2	5.7	18.6	13.5	15.9	8.0	9.7	5.0	17.7	7.0	9.0	5.8	7.6	5.2	2.8	1.5	25.9	12.7	27.6	19.3	23.5	13.2	12.5	6.5	89.6	51.7
TOTAL	103.2	5.7	43.6	14.8	25.9	8.6	14.7	5.0	402.7	10.0	29.0	6.2	7.6	5.2	17.8	1.9	505.9	15.8	72.6	21.0	33.5	13.7	32.5	6.9	644.6	57.4

Table 9d. ***Dead Stratum—Damage Intensity Following A Spruce Budworm Outbreak by Live Douglas-fir and Other Host Species, 300 Acres, Carson National Forest, 1991.***

DIA CL	DOUGLAS-FIR CROWN DAMAGE								OTHER HOST SPECIES CROWN DAMAGE								TOTAL ALL HOST SPECIES CROWN DAMAGE								GRAND TOT	
	NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY			
	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A
<5	205.7	0.6	8.6	0.0	8.6	0.1	17.1	0.0	282.9	0.0	17.1	0.0	42.9	2.0	0.0	0.0	488.6	0.7	25.7	0.0	51.4	2.1	17.1	0.0	582.9	2.7
5	3.2	0.6	0.0	0.0	0.0	0.0	2.0	0.3	1.5	0.3	1.9	0.3	5.9	0.9	1.7	0.3	4.7	0.9	1.9	0.3	5.9	0.9	3.7	0.6	16.2	2.6
6	2.6	0.6	0.0	0.0	5.2	1.1	2.6	0.6	1.1	0.3	1.4	0.3	0.0	0.0	2.6	0.6	3.7	0.9	1.4	0.3	5.2	1.1	5.3	1.1	15.6	3.4
7	1.8	0.6	1.8	0.6	2.8	0.9	8.3	2.6	0.9	0.3	0.0	0.0	1.8	0.6	1.1	0.3	2.7	0.9	1.8	0.6	4.7	1.4	9.4	2.9	18.6	5.7
8	0.8	0.3	0.0	0.0	4.6	1.7	1.5	0.6	0.0	0.0	1.5	0.6	0.0	0.0	0.0	0.0	0.8	0.3	1.5	0.6	4.6	1.7	1.5	0.6	8.4	3.1
9	1.2	0.6	2.3	1.1	4.2	2.0	3.0	1.4	0.6	0.3	0.0	0.0	0.0	0.0	0.5	0.3	1.7	0.9	2.3	1.1	4.2	2.0	3.5	1.7	11.8	5.7
10	2.4	1.4	0.5	0.3	2.5	1.4	1.4	0.9	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	2.8	1.7	0.5	0.3	2.5	1.4	1.4	0.9	7.2	4.3
11	1.2	0.9	2.8	2.0	3.2	2.3	0.4	0.3	0.8	0.6	0.0	0.0	1.3	0.9	0.0	0.0	1.9	1.4	2.8	2.0	4.5	3.1	0.4	0.3	9.7	6.9
12	0.7	0.6	2.0	1.7	1.0	0.9	0.7	0.6	1.0	0.9	0.3	0.3	0.4	0.3	0.0	0.0	1.7	1.4	2.4	2.0	1.4	1.1	0.7	0.6	6.1	5.1
13	1.2	1.1	1.4	1.4	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.6	0.6	0.6	0.6	1.8	1.7	1.4	1.4	1.2	1.1	1.2	1.1	5.5	5.4
14	0.0	0.0	0.5	0.6	0.5	0.6	0.7	0.9	1.5	1.7	0.3	0.3	0.2	0.3	0.0	0.0	1.5	1.7	0.8	0.9	0.8	0.9	0.7	0.9	3.8	4.3
15	0.0	0.0	0.7	0.9	0.2	0.3	0.0	0.0	1.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.4	0.7	0.9	0.2	0.3	0.0	0.0	2.0	2.6
16+	0.9	2.0	1.2	2.3	1.3	2.3	0.2	0.3	1.3	2.6	0.1	0.3	0.2	0.3	0.2	0.6	2.1	4.6	1.3	2.6	1.5	2.6	0.4	0.9	5.4	10.6
SUBT 5+	15.7	8.6	13.4	10.9	26.2	14.0	21.4	8.9	10.7	9.1	5.5	2.0	10.4	3.7	6.8	2.6	26.4	17.7	18.9	12.9	36.6	17.7	28.2	11.4	110.1	59.7
TOTAL	221.4	9.2	22.0	10.9	34.7	14.1	38.6	8.9	293.5	9.2	22.6	2.0	53.3	5.7	6.8	2.6	515.0	18.4	44.6	12.9	88.0	19.8	45.4	11.4	693.0	62.4

Table 9e. All Strata (Weighted By Area)—Damage Intensity Following A Spruce Budworm Outbreak by Live Douglas-fir and Other Host Species, 27,900 Acres, Carson National Forest, 1991.

DIA CL	DOUGLAS-FIR CROWN DAMAGE								OTHER HOST SPECIES CROWN DAMAGE								TOTAL ALL HOST SPECIES CROWN DAMAGE								GRAND TOT	
	NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY		NONE		LIGHT		MEDIUM		HEAVY			
	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A	T/A	B/A
<5	202.1	1.5	30.9	1.3	12.6	0.4	12.1	0.7	1159.2	4.4	54.0	1.0	18.5	0.2	14.6	0.4	1361.3	5.9	84.9	2.3	31.1	0.6	26.7	1.1	1504.1	9.9
5	4.1	0.7	4.1	0.7	3.3	0.5	1.1	0.2	13.1	2.2	4.4	0.7	0.4	0.1	0.4	0.1	17.2	2.8	8.5	1.4	3.8	0.6	1.5	0.3	31.0	5.1
6	1.4	0.3	1.9	0.4	3.4	0.8	1.3	0.3	12.5	2.8	3.0	0.7	2.3	0.5	0.0	0.0	13.9	3.1	4.9	1.1	5.6	1.3	1.3	0.3	25.7	5.8
7	2.5	0.8	2.9	0.9	2.1	0.6	1.2	0.4	6.5	1.9	2.2	0.7	0.8	0.2	0.2	0.1	9.0	2.7	5.1	1.6	2.9	0.9	1.4	0.4	18.4	5.6
8	2.1	0.8	3.0	1.2	1.5	0.6	0.8	0.3	8.2	3.2	3.0	1.2	1.5	0.6	0.6	0.2	10.3	4.0	6.0	2.4	3.0	1.2	1.5	0.6	20.7	8.1
9	2.1	1.0	5.0	2.4	1.6	0.8	0.8	0.4	5.4	2.6	1.3	0.6	1.5	0.7	0.2	0.1	7.5	3.7	6.2	3.0	3.1	1.5	1.1	0.5	17.9	8.7
10	1.5	0.9	2.4	1.4	1.4	0.9	0.6	0.3	5.2	3.1	1.5	0.9	0.9	0.5	0.0	0.0	6.8	4.1	4.0	2.3	2.3	1.4	0.6	0.3	13.6	8.1
11	1.3	0.9	2.6	1.8	1.3	0.9	0.3	0.2	2.5	1.8	1.3	0.9	0.6	0.5	0.1	0.1	3.8	2.7	3.9	2.8	1.9	1.4	0.3	0.2	10.0	7.1
12	1.7	1.4	1.9	1.6	0.9	0.7	0.3	0.2	1.8	1.5	1.4	1.2	0.5	0.4	0.0	0.0	3.5	2.9	3.3	2.8	1.4	1.2	0.3	0.2	8.4	7.1
13	1.4	1.3	1.8	1.7	0.5	0.5	0.4	0.4	1.2	1.2	1.0	0.9	0.4	0.4	0.1	0.1	2.6	2.5	2.7	2.7	0.9	0.9	0.4	0.4	6.7	6.5
14	1.1	1.2	0.9	1.1	0.6	0.6	0.1	0.1	1.1	1.2	0.6	0.7	0.1	0.1	0.0	0.0	2.2	2.5	1.6	1.8	0.6	0.7	0.1	0.1	4.4	5.0
15	0.6	0.7	1.1	1.5	0.2	0.3	0.1	0.2	0.9	1.1	0.5	0.6	0.3	0.3	0.0	0.1	1.4	1.9	1.6	2.1	0.5	0.6	0.2	0.2	3.7	4.8
16+	2.0	4.3	2.9	6.3	1.1	2.2	0.5	1.0	1.8	3.9	1.0	1.8	0.5	0.9	0.1	0.1	3.9	8.2	3.9	8.1	1.6	3.2	0.5	1.1	9.9	20.5
SUBT 5+	21.8	14.5	30.5	20.9	17.9	9.5	7.3	3.9	60.3	26.6	21.3	11.0	9.8	5.3	1.7	0.8	82.1	41.1	51.8	31.9	27.7	14.8	9.1	4.7	170.6	92.5
TOTAL	223.9	15.9	61.4	22.2	30.5	9.8	19.4	4.6	1219.5	31.1	75.3	12.0	28.3	5.5	16.4	1.2	1443.4	47.0	136.7	34.2	58.8	15.4	35.8	5.8	1674.6	102.4

Figure 7a. ***No Damage Stratum—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 8,100 Acres, Carson National Forest, 1991.***

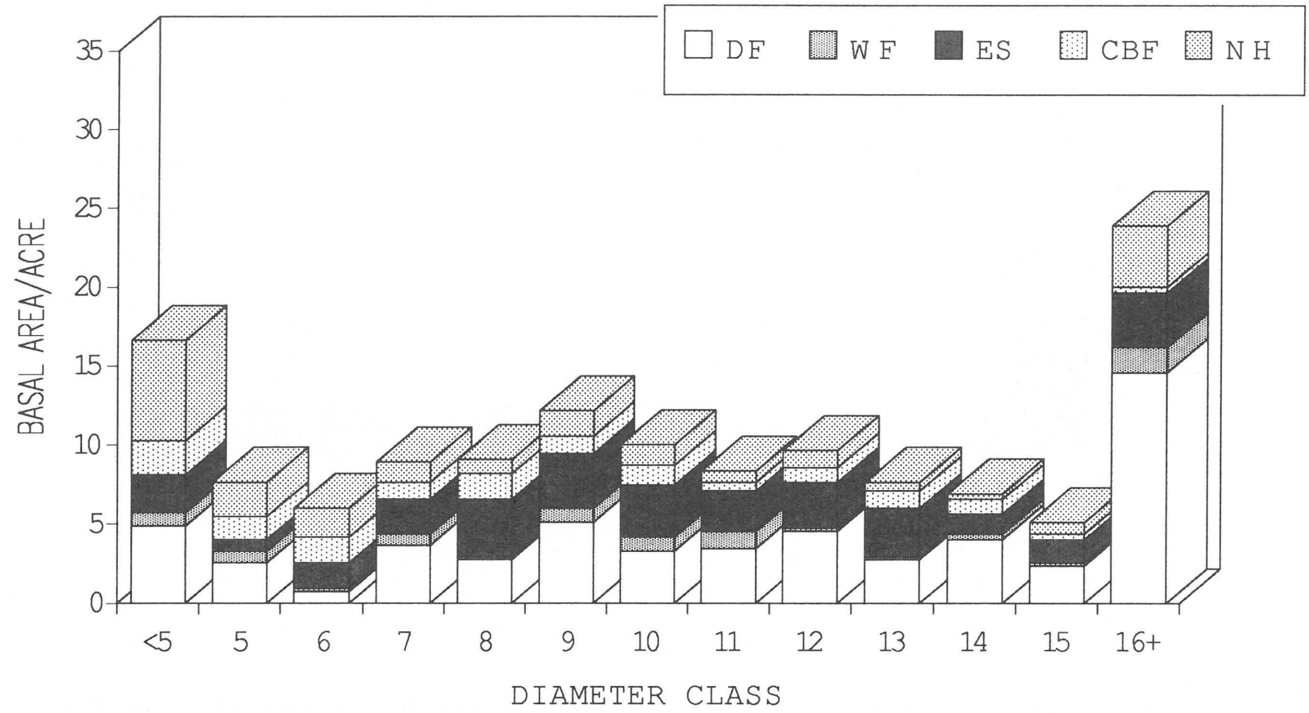

Figure 7b. ***Light-Medium Damage Stratum—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 10,500 Acres, Carson National Forest, 1991.***

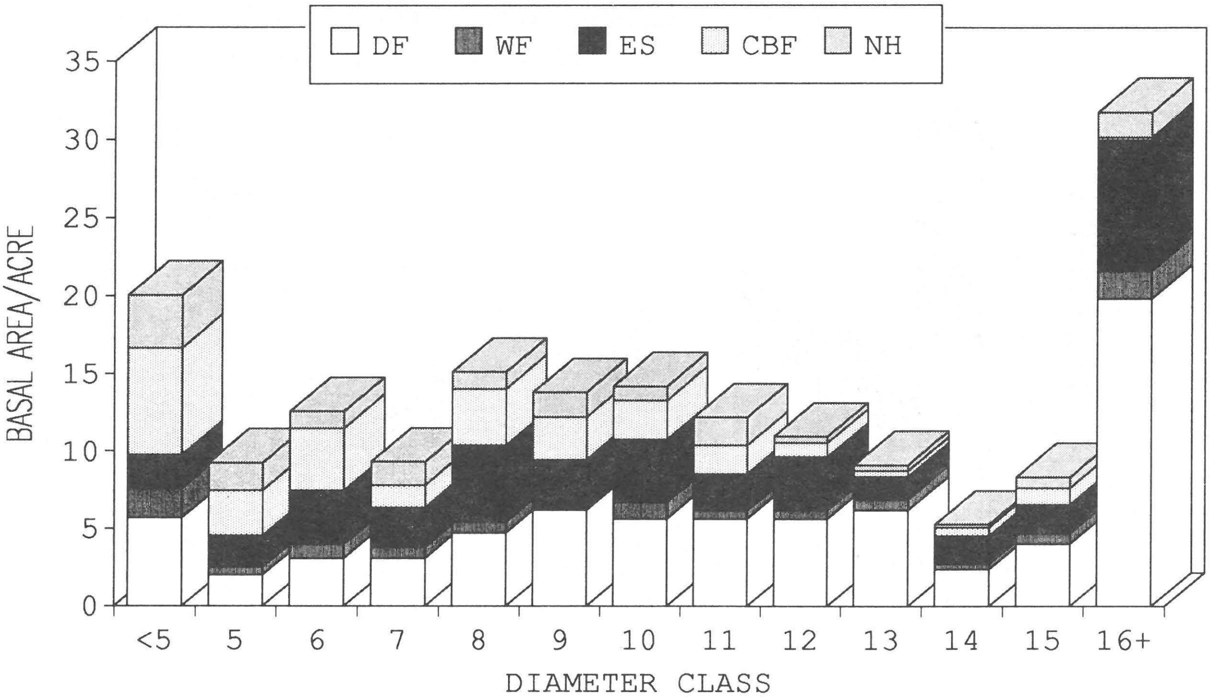

Figure 7c. ***Heavy Damage Stratum—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 9,000 Acres, Carson National Forest, 1991.***

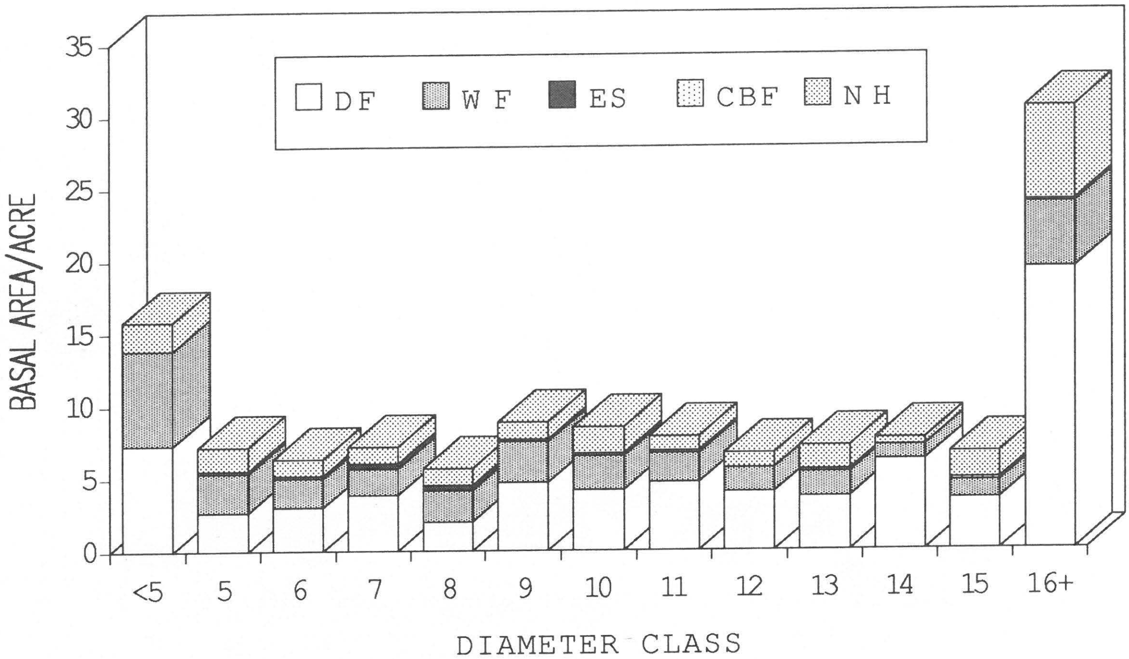

Figure 7d. ***Dead Stratum—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 300 Acres, Carson National Forest, 1991.***

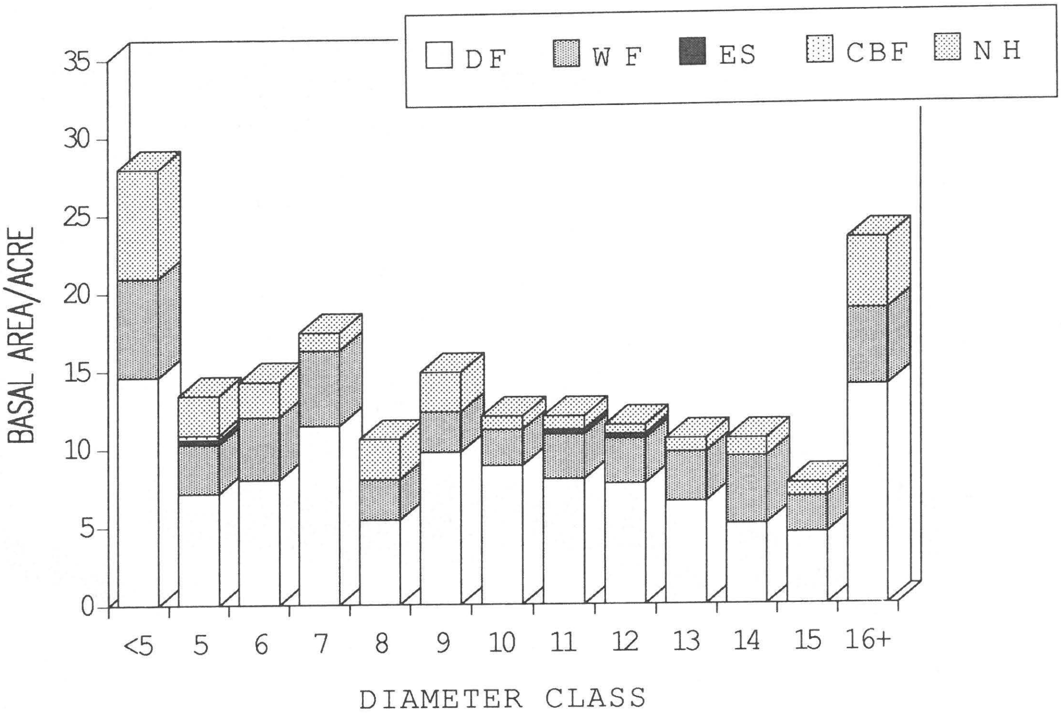

Figure 7e. ***All Strata (Weighted by Area)—Stand Structure (Living and Dead) Following A Western Spruce Budworm Outbreak, 27,900 Acres, Carson National Forest, 1991.***

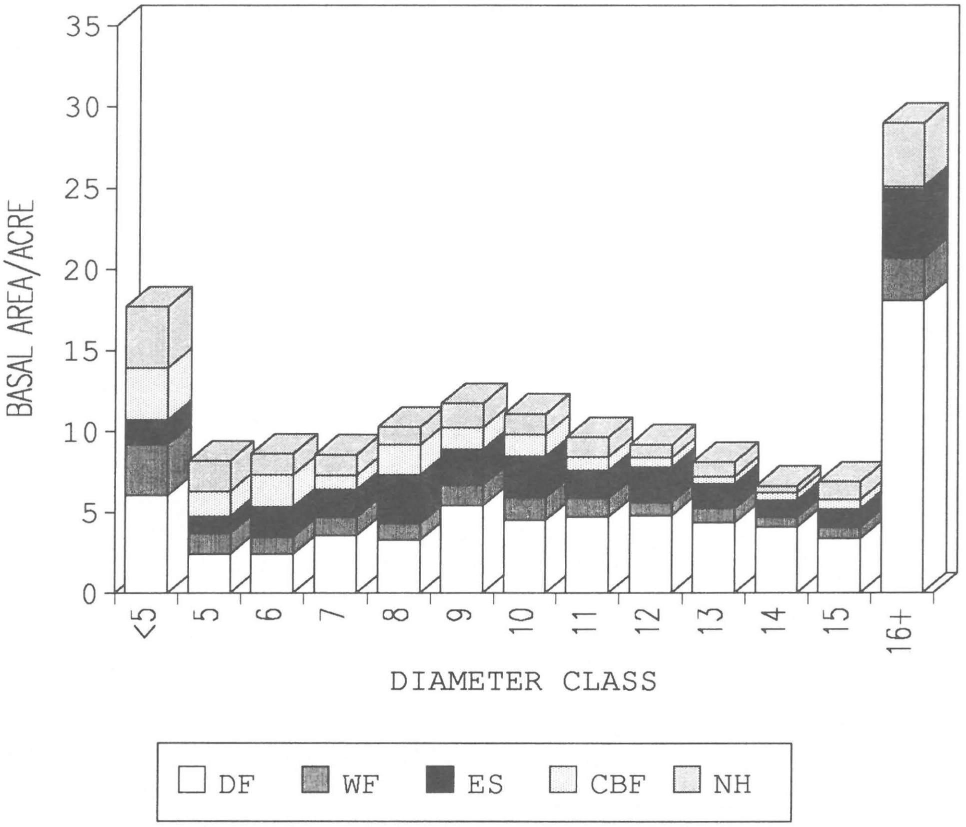

Figure 8a. *No Damage Stratum—Condition of Douglas-fir and Other Host Tree Species as Determined By the 1991 Ground Survey, Carson National Forest—8,100 Acres.*

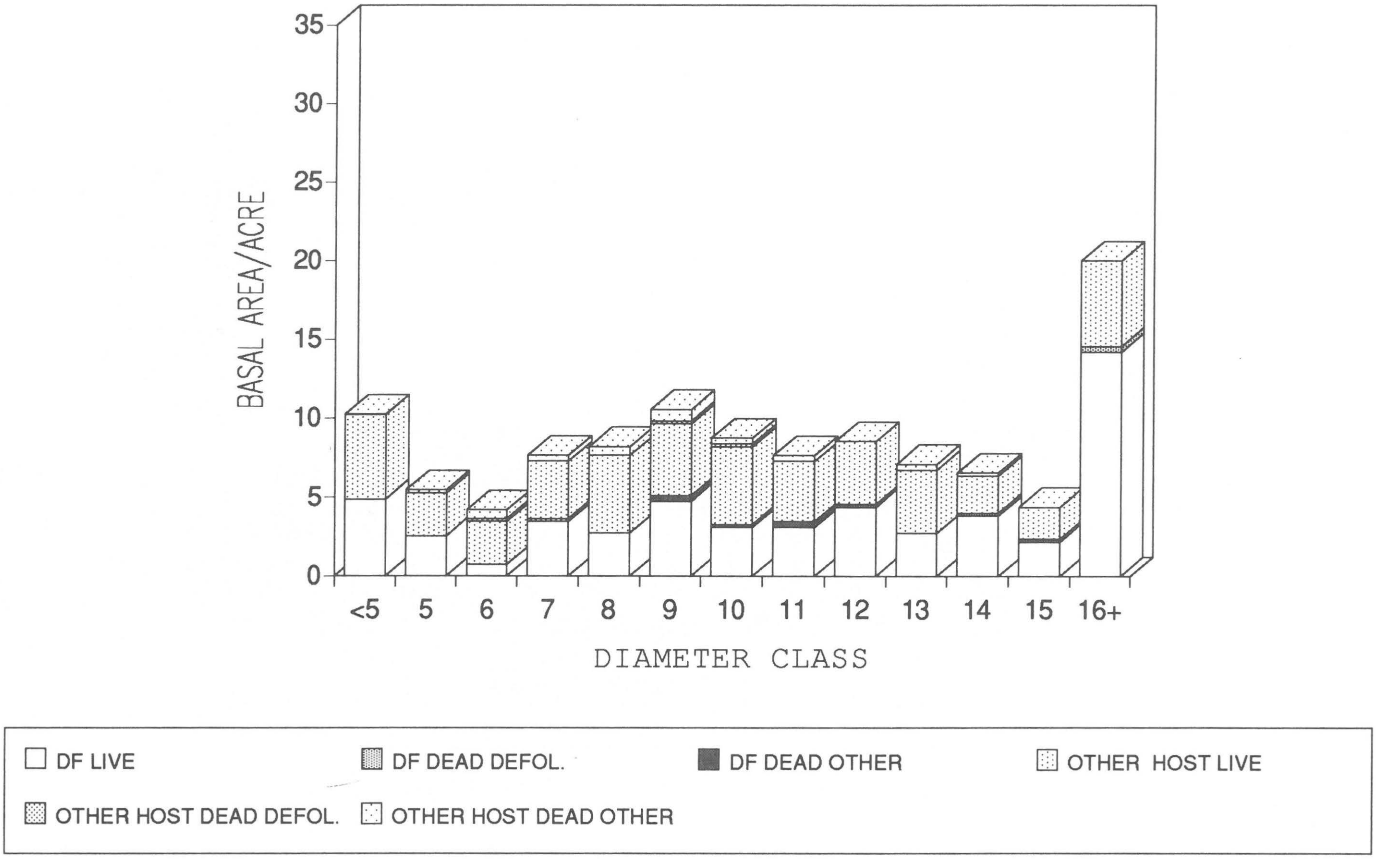

Figure 8b. Light-Medium Damage Stratum—Condition of Douglas-fir and Other Host Tree Species as Determined by the 1991 Ground Survey, Carson National Forest—10,500 Acres.

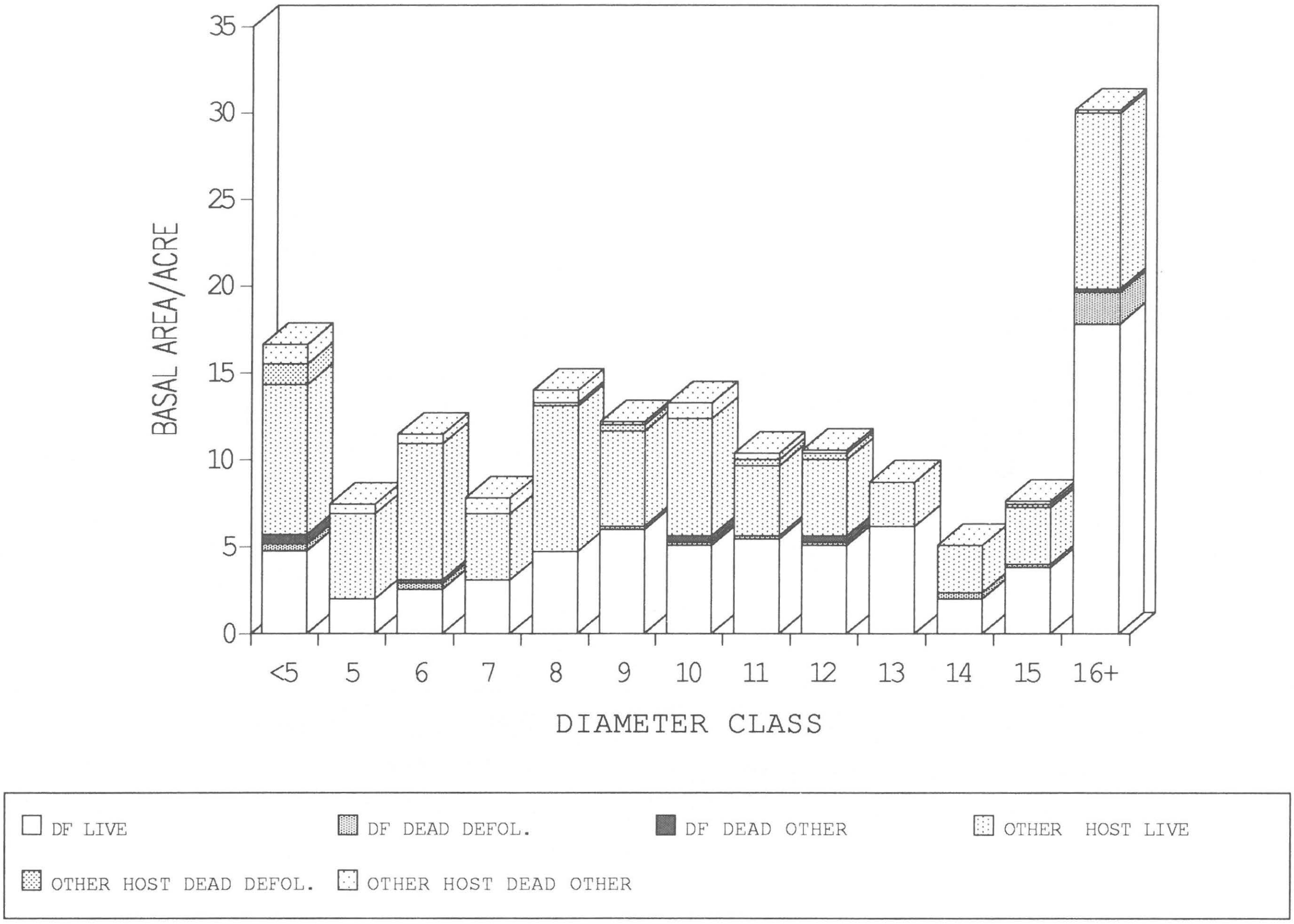

Figure 8c. ***Heavy Damage Stratum—Condition of Douglas-fir and Other Host Tree Species as Determined by the 1991 Ground Survey, Carson National Forest—9,000 Acres.***

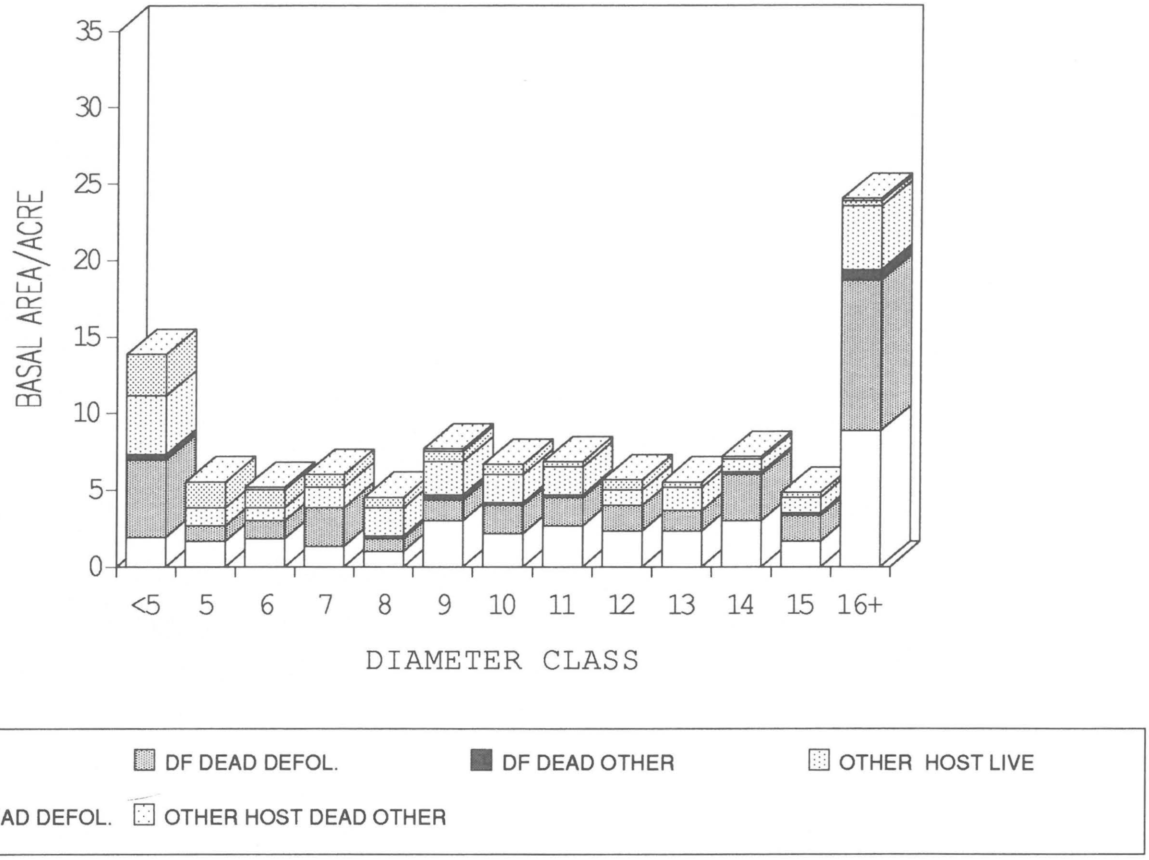

Figure 8d. ***Dead Stratum—Condition of Douglas-fir and Other Host Tree Species as Determined by the 1991 Ground Survey, Carson National Forest—300 Acres.***

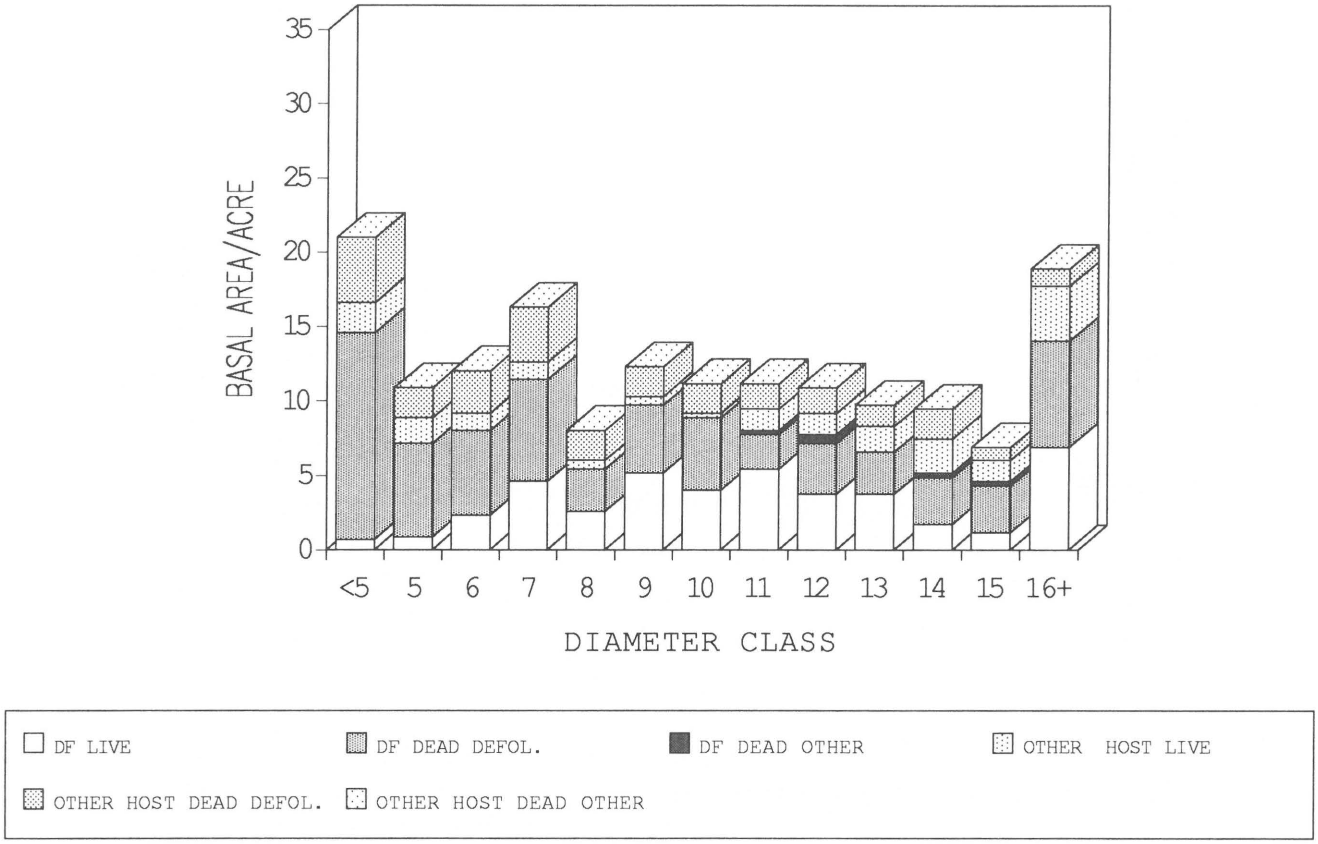

Figure 8e. ***All Strata (Weighted by Area)—Condition of Douglas-fir and Other Host Tree Species as Determined by the 1991 Ground Survey, Carson National Forest — 27,900 Acres.***

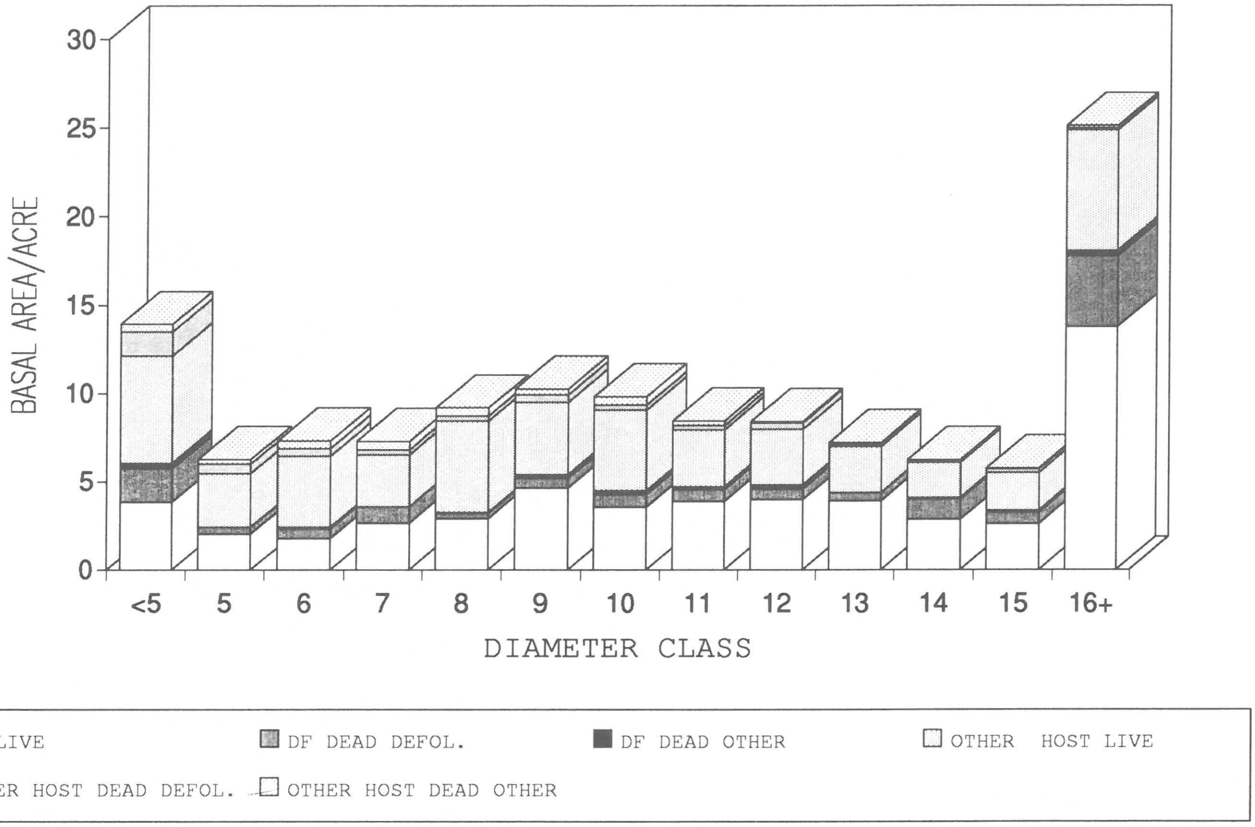

Figure 9a. ***No Damage Stratum—Douglas-fir Damage Intensity Following A Spruce Budworm Outbreak, 8,100 Acres, Carson National Forest, 1991.***

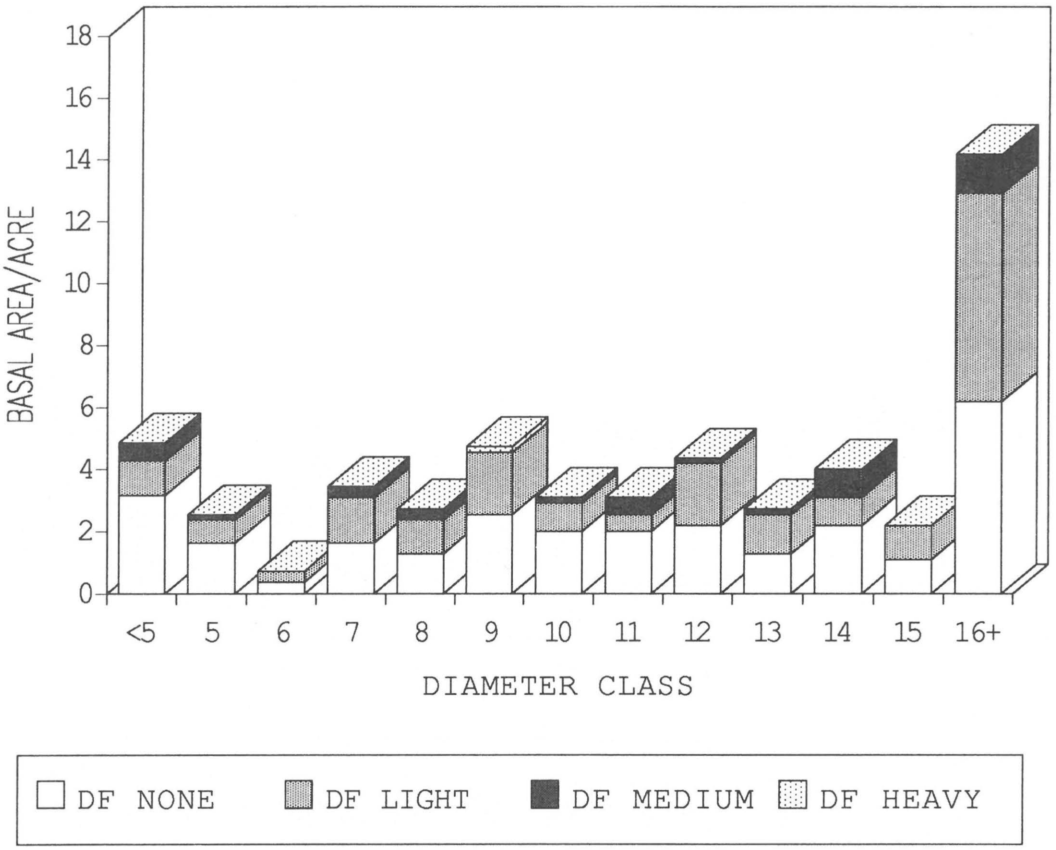

Figure 9b. ***No Damage Stratum—Other Host Tree Species Damage Intensity Following a Spruce Budworm Outbreak, 8,100 Acres, Carson National Forest, 1991.***

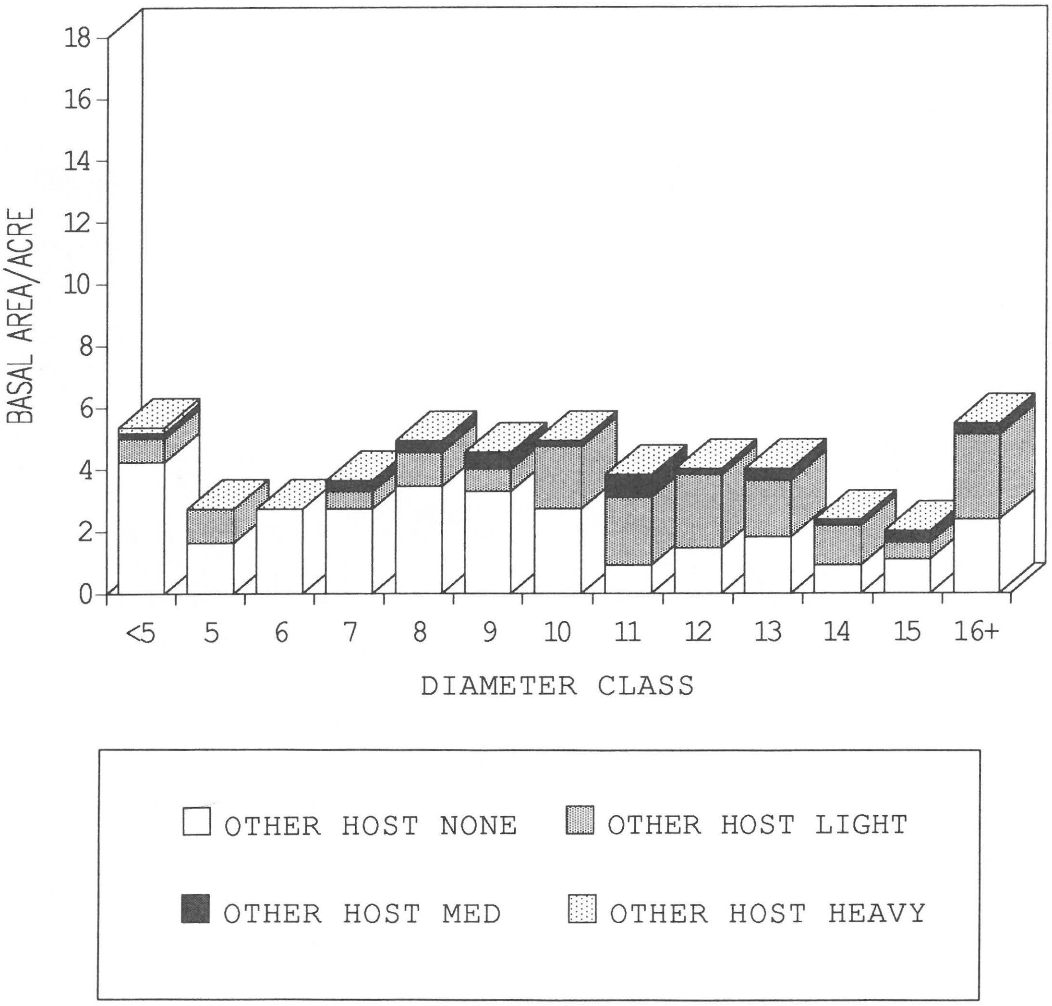

Figure 9c. ***Light-Medium Damage Stratum—Douglas-fir Damage Intensity Following A Spruce Budworm Outbreak, 10,500 Acres, Carson National Forest, 1991.***

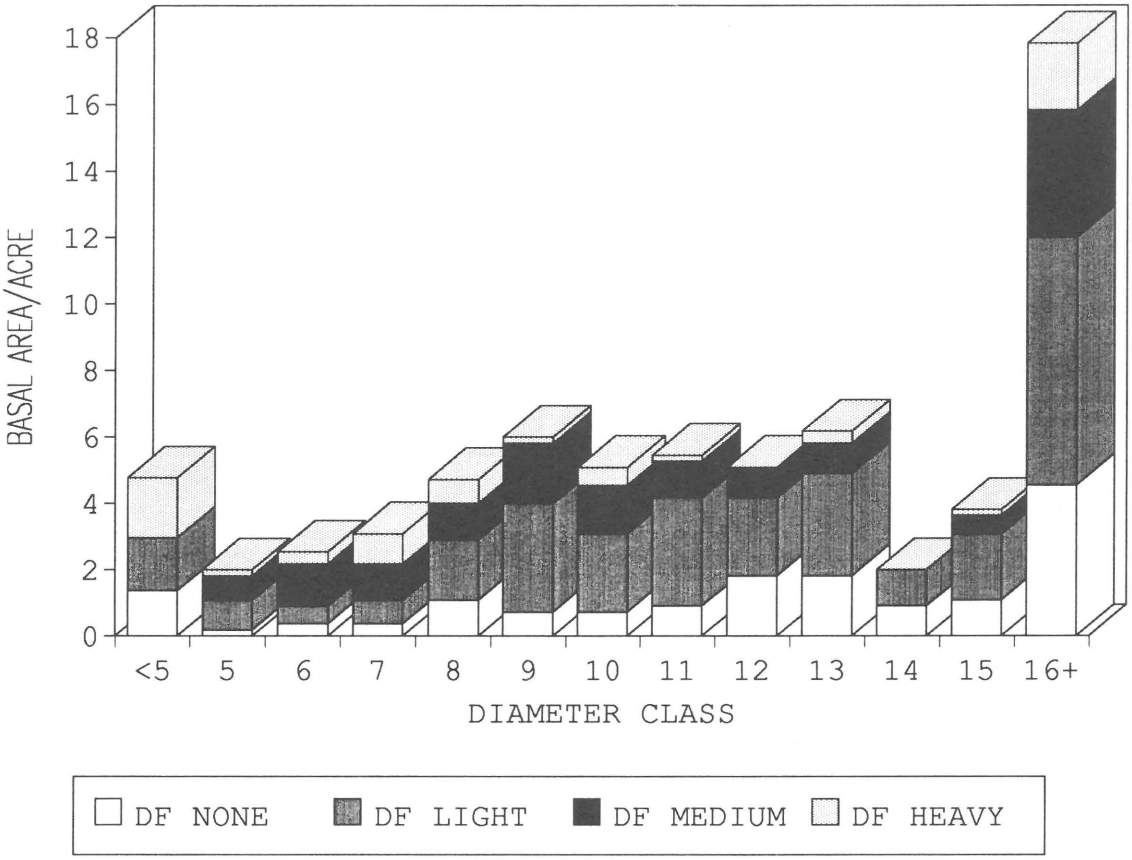

Figure 9d. ***Light-Medium Damage Stratum—Other Host Tree Species Damage Intensity Following A Spruce Budworm Outbreak, 10,500 Acres, Carson National Forest, 1991.***

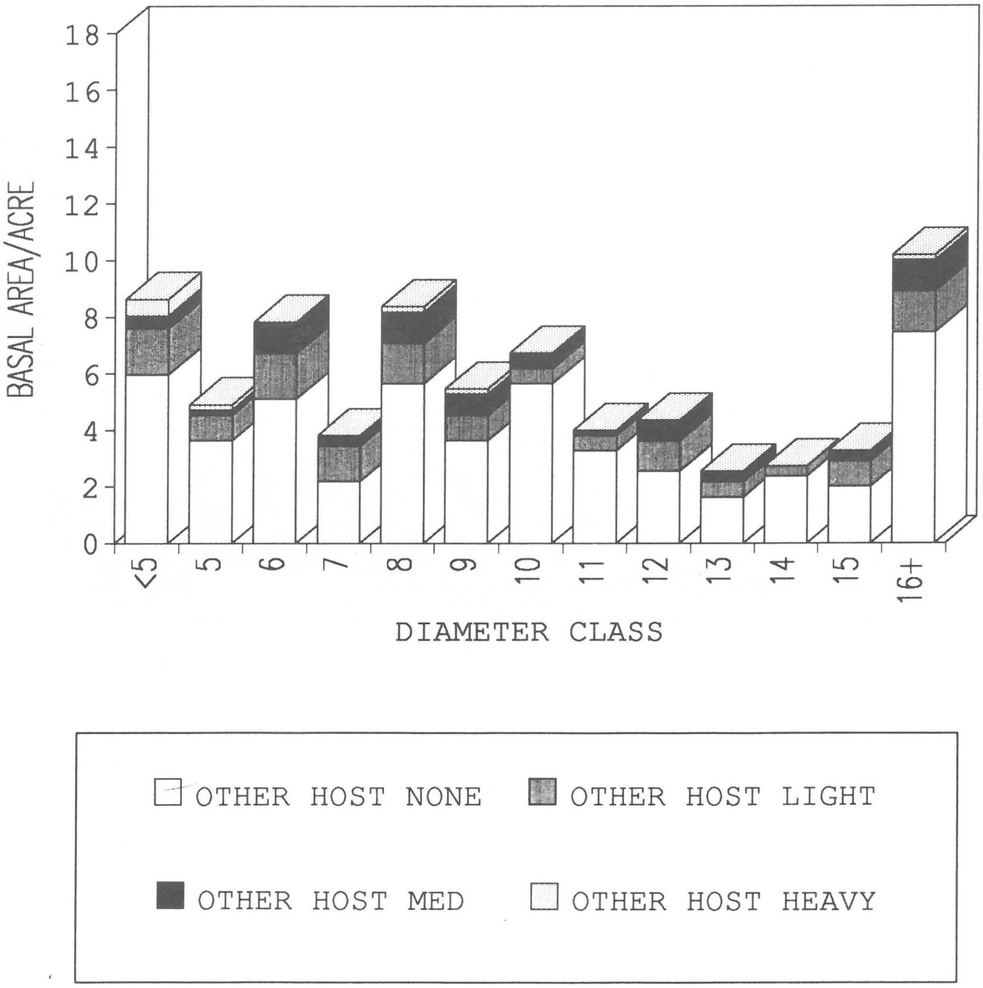

Figure 9e. ***Heavy Damage Stratum—Douglas-fir Damage Intensity Following A Spruce Budworm Outbreak, 9,000 Acres, Carson National Forest, 1991.***

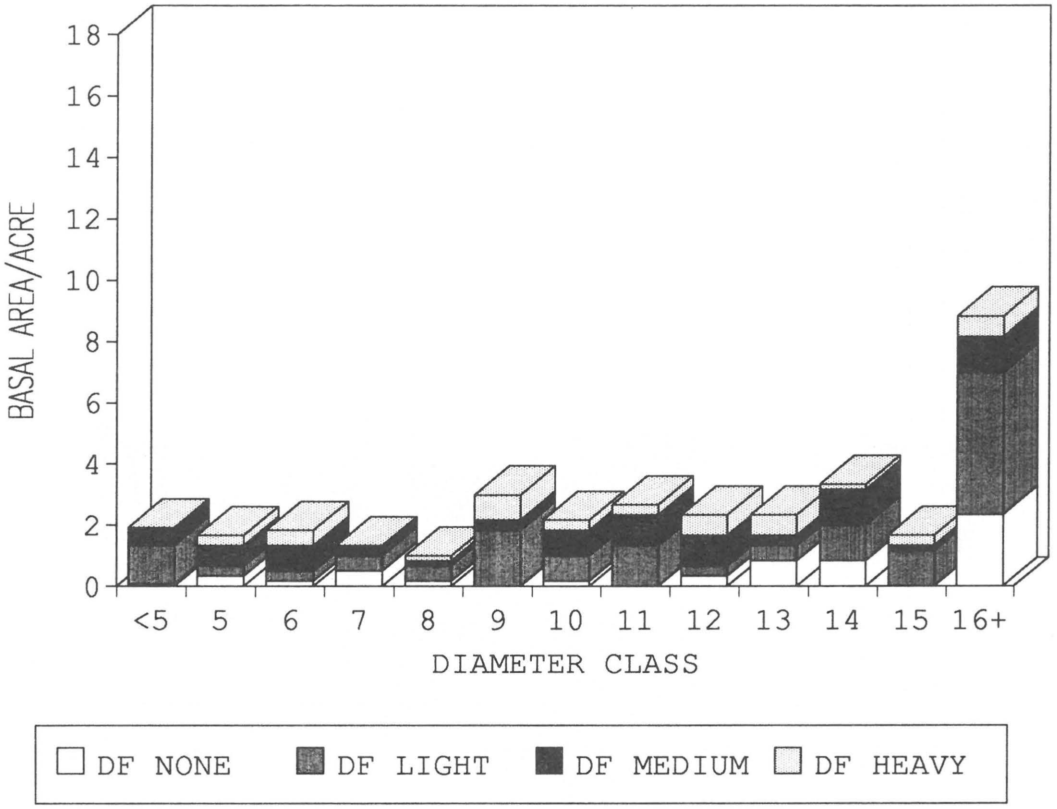

Figure 9f. ***Heavy Damage Stratum—Other Host Tree Species Damage Intensity Following A Western Spruce Budworm Outbreak, 9,000 Acres, Carson National Forest, 1991.***

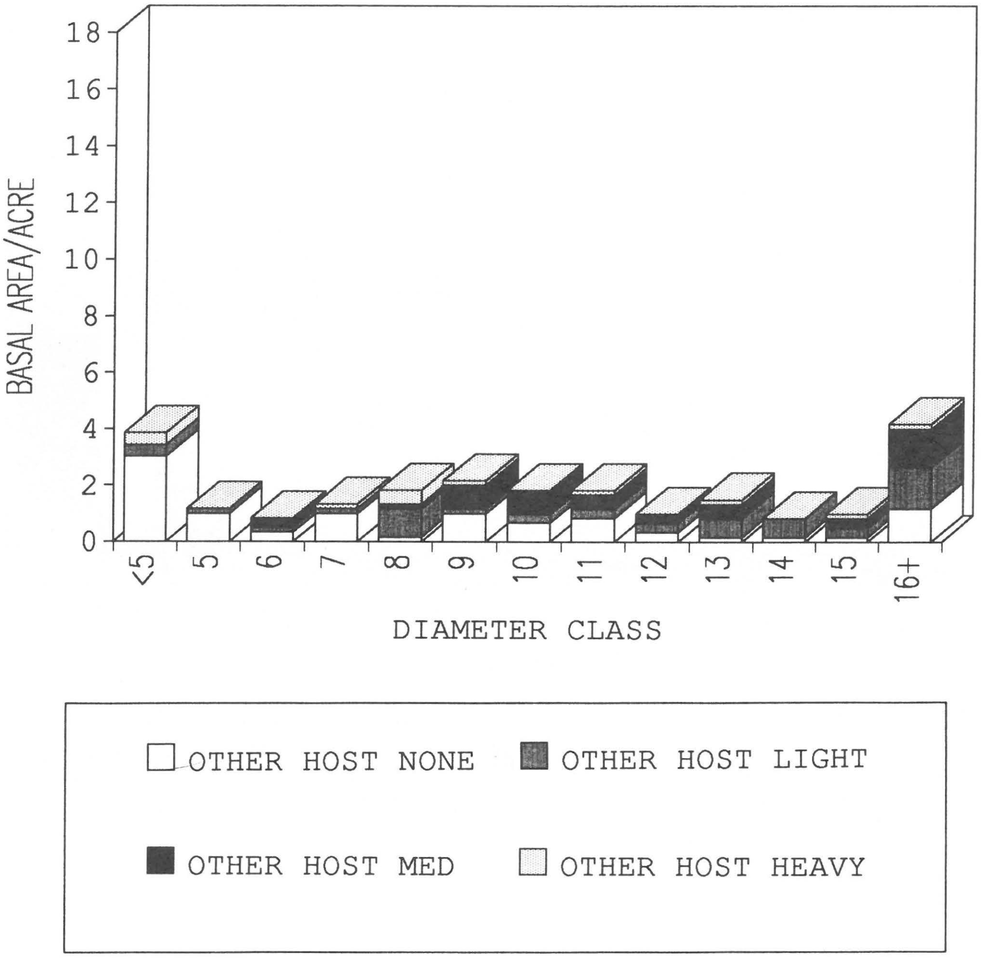

Figure 9g. ***Dead Stratum—Douglas-fir Damage Intensity Following A Spruce Budworm Outbreak, 300 Acres, Carson National Forest, 1991.***

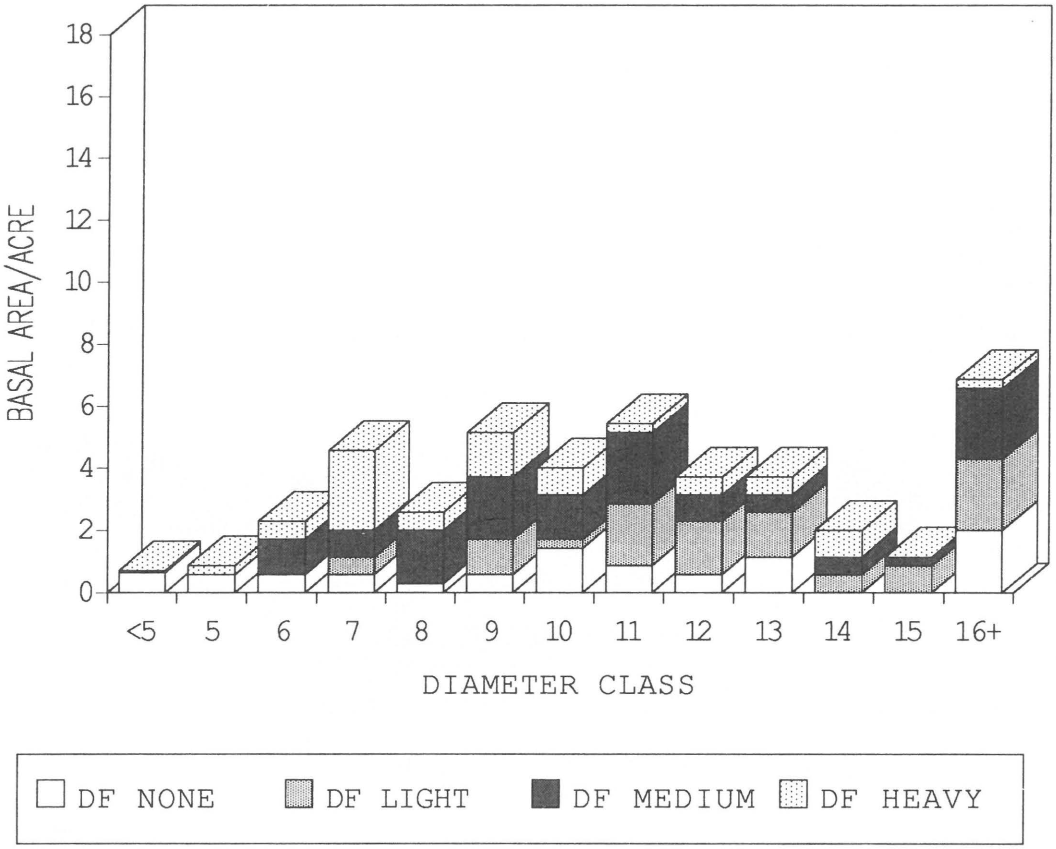

Figure 9h. ***Dead Stratum—Other Host Species Damage Intensity Following A Western Spruce Budworm Outbreak, 300 Acres, Carson National Forest, 1991.***

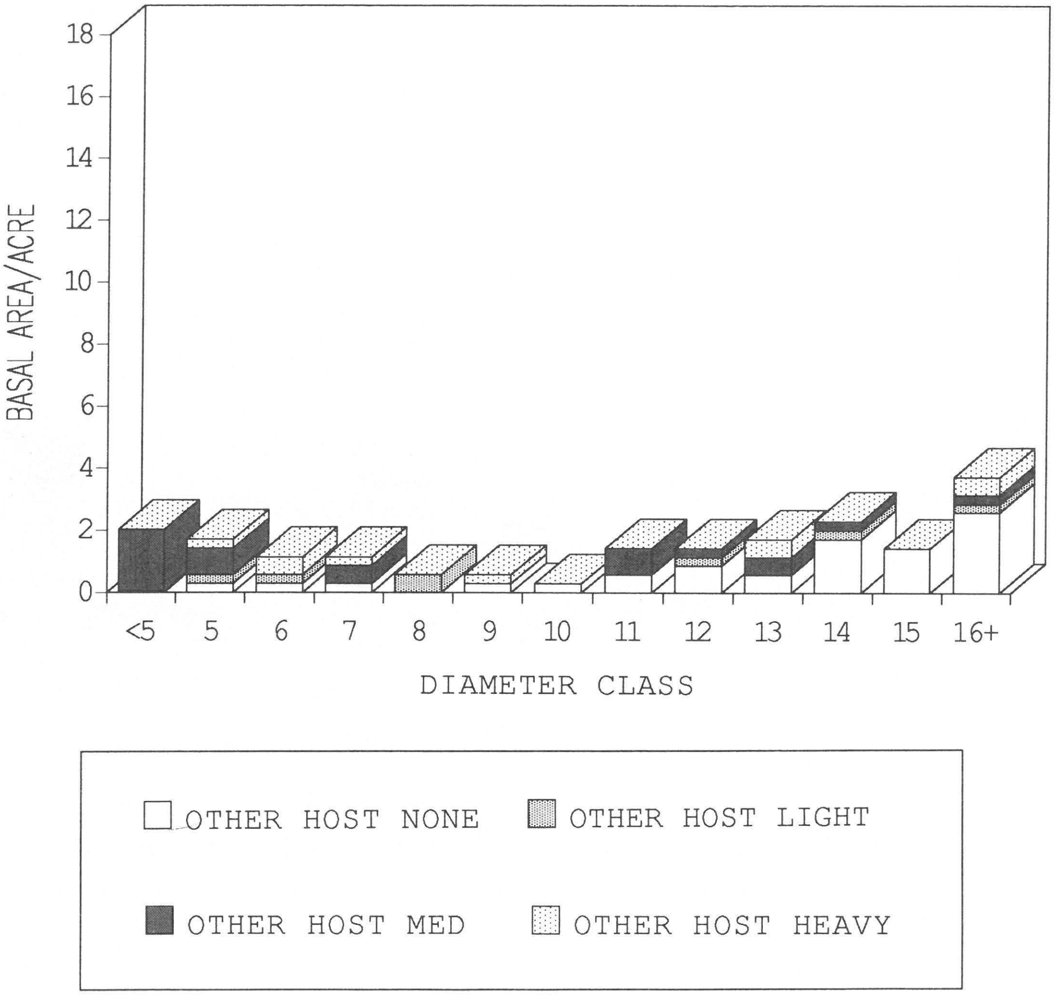

Figure 9i. ***All Strata (Weighted by Area)—Douglas-fir Damage Intensity Following A Western Spruce Budworm Outbreak, 27,900 Acres, Carson National Forest, 1991.***

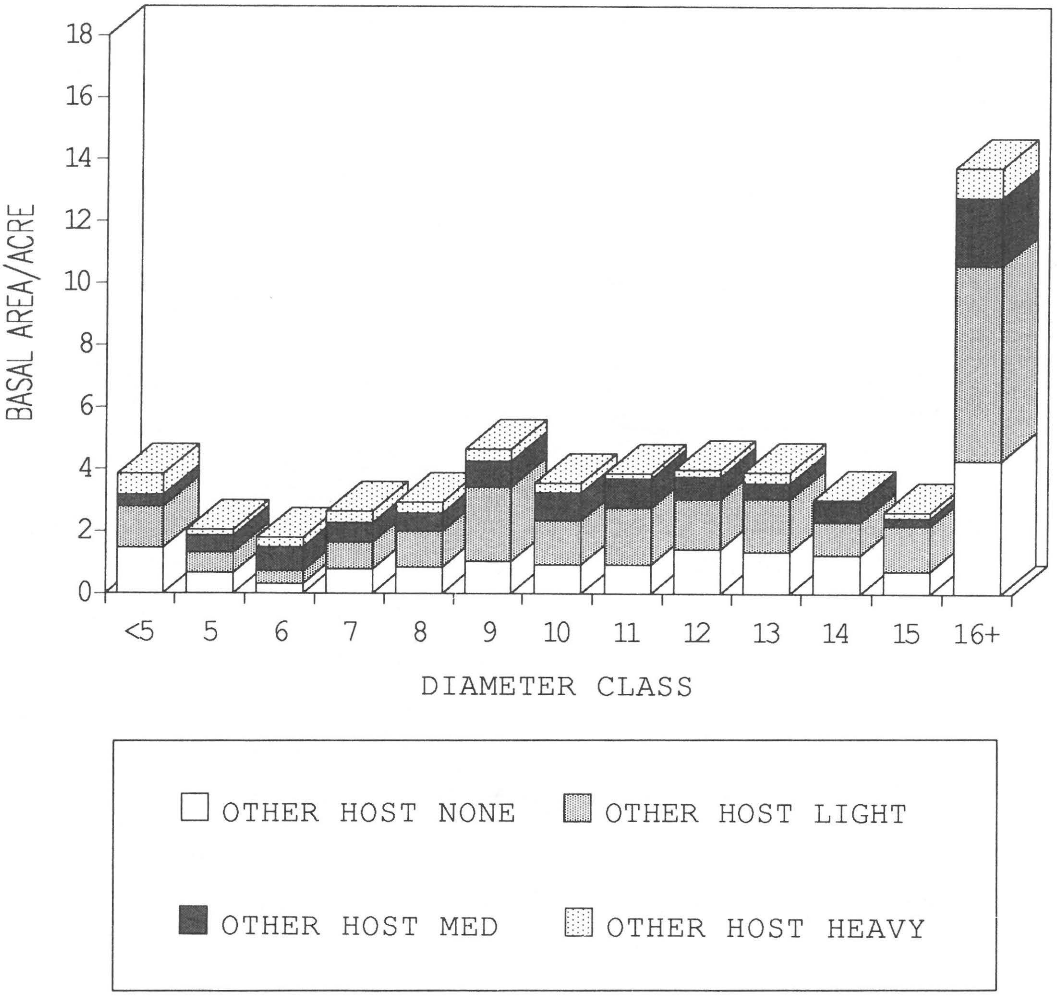

Figure 9j. ***All Strata (Weighted by Area)—Other Host Tree Species Damage Intensity Following A Western Spruce Budworm Outbreak, 27,900 Acres, Carson National Forest, 1991.***